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SILESIA AND THE PEACE TREATY.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 24th January, 1922.

BY LIEUT.-COLONEL R. H. HAINING, D.S.O., R.A.

Colonel B. R. Kirwan, C.B., C.M.G., Director of Artillery in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, our Lecturer this evening is Lieut.-Colonel Haining who has, until recently, been a member of the Operations branch of the General Staff at the War Office. Even though Colonel Haining is a General Staff Officer he is still a gunner. The subject of his lecture is "Silesia and the Peace Treaty" on which he is very well qualified to speak. I will ask Colonel Haining to proceed with his lecture.

COLONEL HAINING: Colonel Kirwan, Ladies and Gentlemen:—Upper Silesia has been to the fore in the newspapers for a considerable time and it is probable that the majority of soldiers have some knowledge of the recent happenings in connection with the holding of a plebiscite there. It is, nevertheless, quite likely that many are rather vague as to why Upper Silesia should ever have been the subject of a plebiscite and of the particular conditions connected with the area which made it a subject of importance at the Peace Conference.

I propose, therefore, to give a slight survey of the whole question and to deal with it as a continuous narrative, so that it may be possible to comprehend the trend of events there and the reason for their relative importance.

With this idea I think one can divide the lecture into three parts:

(i). The history of Upper Silesia up to the outbreak of the great war.

(ii). The provisions of the Peace Treaty with regard to Upper Silesia and the events in the period extending from the Peace Treaty to the taking of the plebiscite and later to the decision of the League of Nations.

(iii). The situation created by the decision of the League of Nations and the outlook for the future.

(i). *History.*

The history of Silesia may be taken, for all practical purposes, as starting at the fall of the Moravian Empire, when, in the 10th century, Silesia was partly under Poland and partly under Bohemia. At the end of that century practically the whole of Silesia was under the

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dominion of Boleslav the Great of Poland. This was a crucial period in the country's history, for it decided that its future was not to be linked with that of the Eastern Slavs, but that it was to be forced by the influence of Polish and Bohemian conquerors into the current of Western European history by bringing it in contact with the organisation of the Romish Church and with the feudal constitution of the Western Kingdoms.

In the 11th century, we again find continuous struggles between Poles and Bohemians and also the first German intervention.

Boleslav the Great died in 1025 and the Bohemians, under Bretislav, Duke of Bohemia, reconquered the country in 1040.

Under Boleslav the Second, (1058—1079) there was a Polish revival, in the course of which Silesia again became Polish, who held it against a German invasion under the Emperor Henry Vth in 1109.

Its history—as a separate state—really began with the death of Boleslav the Third of Poland, in 1139. In the preceding year, he had made a partition of his Polish territories among his four sons, and this partition led to the independence of Silesia and the Germanization of the greater part of it. For his eldest son, Vladislav, who had an elder son's portion, (which included Silesia) was deposed by his brother Boleslav (the Fourth) in 1146 and died in Germany, but in 1163, by the intervention of the Emperor Frederick Barbarossa, Boleslav the Fourth was compelled to restore Silesia to the three sons of Vladislav. One of these died soon after and his share passing to his eldest brother, Silesia became divided into two dukedoms, those of Lower and Upper Silesia with Breslau and Ratibor as their respective capitals. These dukedoms in forty or fifty years, became completely independent of Poland.

The Westernising of Silesia then made rapid progress and the country was gradually split up into a number of dukedoms, among the most important of whose rulers were Henry the Bearded the Duke of Breslau who conquered much of Poland (1202—1238), and his son Henry II who fell at Liegnitz (1241), where he successfully turned back the Mongolian invasion of Germany.

The supremacy of Bohemia was definitely recognised in 1335.

Bohemia passed to the House of Hapsburg in 1556 and Silesia remained part of Bohemia—(with nine principalities or dukedoms in Lower Silesia and eight in Upper Silesia)—as a province in feudal subjection to the Bohemian Crown until its conquest by Frederick the Great (of the House of Brandenburg), who determined on pressing his Silesian claims (which were dubious and had been in abeyance for 200 years till after the death of Great Elector). Frederick the Great invaded Silesia in 1740 and captured Breslau in the following January. This invasion was despite the fact that Frederick the First of Prussia, Frederick the Great's father, had recognised the Pragmatic Sanction, whereby the hereditary dominions of Charles VI (including Silesia) were guaranteed to Maria Theresa. In June, 1742, the Truce of Breslau first gave Prussia that part of Silesia which belonged to her up to 1919, and this was confirmed in 1744 by the Treaty of Dresden.

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Under Frederick the Great and his successors, the economic development of Silesia was very great. Agricultural credits were established, the serfs were emancipated and schools and industries were founded. At the same time there remained a strong local feeling and the "Silesian Nation" is a phrase of frequent occurrence.

Although at times, notably in the war of Bavarian Succession in 1778, and after the military collapse of Prussia in 1806, when Silesia was reduced by Jerome Buonaparte, we find attempts made to establish an independent Silesia, attempts which again occurred in the year of Revolutions (1848) and in 1866 (by an agreement between Austria and Napoleon III), Silesia undoubtedly remained an integral part of Prussia from the time of the Peace of Hubertisburg in 1768 down to the Treaty of Versailles in 1919. Silesian troops took their share in the wars which led to the formation of the German Empire, Silesian Representatives sat in the Reichstag and the Prussian Diet, and although a good deal of trouble was caused by the failure of Frederick William III (1820) to grant Silesia a constitution, yet it would appear that,—on the formation of the Prussian Diet, (in its then existing form) in 1851, and on the further expansion of Prussia into the German Empire in 1870, Silesia was considered a part of Germany just as Saxony or any other State in the Federation.

The Province of Silesia under Prussian rule was divided into three sub-provinces of which Upper Silesia is the most Southern and Lower Silesia is the most Northern.

The Plebiscite Area only concerned Upper Silesia and not all of that, for a small portion to the South round Teschen and Troppau was given to Czecho-Slovakia by the Treaty of Versailles; while definitely German areas on the West were excluded from the scope of the Plebiscite. Lower Silesia and Middle Silesia were definitely German also. The area of the Plebiscite territory was 4,000 square miles and the population about 2,000,000.

Although it is not corrct to say, that Upper Silesia had been German for 700 years, it *is* correct to say that it has not been Polish since the 13th century, and it also correct to say that it has been Prussian for 177 years.

[The lecturer then showed on the map the extent of Upper Silesia, and its boundaries: and pointed out the nature of the country, the area of the Industrial Triangle, and the characteristics of the agricultural portion which made it so sought after from the middle ages down to 1914, as a sporting country ,with its consequent division into large estates with fine residences, all owned by important and powerful families of Prussian or Polish origin.]

Colonel Haining, continuing, said :—now we come to—

Part (ii). *The Treaty of Versailles and Upper Silesia.*

In the original draft of the Treaty of Versailles, the greater part of the sub-province of Upper Silesia was given to Poland. The Germans raised strong objections to this provision of the Treaty which was based

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on the erroneous assumption that the majority of the inhabitants were Poles. The Germans pointed out that although they spoke the Polish dialect, these inhabitants differed from the inhabitants of Poland proper, that Upper Silesia had been separated from Poland for 700 years, that the majority of the inhabitants were of German origin, and that the mining and manufacturing industries were due to German initiative and were of great importance to German economic life. It became doubtful whether the Germans would sign the Treaty unless the provisions about Upper Silesia were modified. Accordingly, with the full support of the whole of the British Delegation and of the Cabinet, Mr. Lloyd George proposed to the Council of Four that the question of the future of Upper Silesia should be decided by plebiscite. This was strongly opposed by President Wilson but eventually Mr. Lloyd George carried his point and the matter was referred to a special Commission of Four members, one each from France, Great Britain, United States of America and Italy. The Commission submitted draft provisions which were adopted by the Council of Four and were embodied in the Peace Treaty with slight amendments. The relevant provisions of the Treaty are contained in Article 88 and the Annex thereto. Article 88 states—In the portion of Upper Silesia included in the boundaries described below, the inhabitants will be called upon to indicate by a vote whether they wish to be attached to Germany or Poland. These boundaries are practically those shown on the map. The Annex stated that the vote shall take place at such date as may be determined by the principal Allied and Associated Powers, but not sooner than 6 months and not later than 18 months after the establishment of the Commission in the area. The plebiscite area to be under the authority of an Inter-national Commission of four members; it shall be occupied by troops belonging to the Allied and Associated Powers and the German Government undertakes to give facilities for the transference of these troops to Upper Silesia.

The right to vote shall be given to all persons without distinction of sex who—

(a) Have completed their twentieth year on the 1st January of the year in which the plebiscite takes place.

(b) Were born in the plebiscite area or have been domiciled there since a date to be determined by the Commission, which shall not be subsequent to the 1st January, 1919, or who have been expelled by the German authorities and have not retained their domicile there.

Persons convicted of political offences shall be enabled to exercise their right of voting.

Every person will vote in the commune where he is domiciled or in which he was born, if he has not retained his domicile in the area.

The result of the vote will be determined by communes according to the majority of votes in each commune.

On the conclusion of the voting, the number of votes cast in each commune will be communicated by the Commission to the principal

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Allied and Associated Powers, with a full report as to the taking of the vote and a recommendation as to the line which ought to be adopted as the frontier of Germany in Upper Silesia. In this recommendation regard will be paid to the wishes of the inhabitants as shown by the vote, and to the geographical and economic conditions of the locality.

With reference to Clause (b) of paragraph 4 of the Annex, the Commission fixed the 1st January, 1904. The result is that no person domiciled in the territory after that date had the right to vote.

It will be observed that the right to vote was given to all persons born in the territory, even though no longer resident there. This provision was introduced by the Chairman of the Special Commission (General Le Rond), which prepared the draft regulations for incorporation in the Treaty.

The Plebiscite.

The number of registered voters was 1,220,514, of whom 191,154 were non-residents or out-voters.

The voting took place on the 20th March, 1921.

The results of the vote were, after verification, confirmed by the Inter-Allied Commission's Ordinance of the 24th April.

Of the 1,522 communes, 844 had a majority for Germany and 678 a majority for Poland.

The Inter-Allied Commission was unfortunately not given sufficient time to examine the results and make its recommendation to the Principal Allied and Associated Powers. The French President drew up a report advocating one frontier, while the British and Italian Commissioners in a joint report recommended another, (shown on map), the Italian Commissioner adding a rider proposing the allocation to Poland of a group of nine communes on the southern edge of the Industrial Triangle.

We have somewhat anticipated certain events which took place prior to the holding of the plebiscite, and must hark back for a while. We saw just previously that under the Peace Treaty which was signed in 1919, a plebiscite was to be held within 6 to 18 months of the establishment of a commission in the district. After the provisions of the Peace Treaty were known, there was a good deal of fighting between the Germans and Poles on their various frontiers during 1919 without any definite result and it was in January, 1920, when the Danzig plebiscite was to the fore, that the Allied High Commission in Silesia was established and French and German troops, to a total number of 6 to 9 battalions, were sent to the country. No British troops were sent to Silesia until early in March, 1921, when a brigade of Infantry was sent from the Rhine to assist in maintaining order. This brigade was there during the voting, which took place without disturbance, but on the outbreak of industrial trouble in England early in April, the 4 battalions were withdrawn from Silesia to Cologne to replace 4 sent home from Cologne to England. After the plebiscite, there broke out in April and May, 1921, an insurrection in Silesia on a somewhat

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large scale. This was a well organised "Putsch" on the part of the Polish inhabitants with a view to stultifying the result of the plebiscite which had been a tremendous disappointment to them and to their backers in its overwhelming German majority. For a time the country was in a state of serious disorder.

The story of the rising is briefly as follows :—

Early in April, the British troops were withdrawn and on the 2nd May there was a strike of Polish miners in the Upper Silesia industrial area followed by a rising on the 3rd May with fighting in Beuthen, Tarnowitz and Königshutte. The Poles were led by Korfanty, a thorough adventurer, who believed, not unnaturally, that possession was nine-tenths of the law and that if the Poles were in possession of more of the country than the plebiscite appeared to justify they were likely to be able to bargain with the balance. By the 7th May, the Poles had occupied Gleiwitz, Gr. Strehlitz, Lublinitz and Rosenberg and had reached what was called the Korfanty Line. On the 21st May, the Germans who, in view of the paucity of the Allied troops on the spot, had organised themselves into a defensive force, attacked the Poles near Oppeln and Ratibor and fighting was prevalent in these areas and also at Leschnitz and Stubendorf. Consequently, towards the end of May, it became increasingly clear, from the attitude of the remainder of the Allies, that if the success of the Korfanty coup was be prevented it would be necessary to despatch a further allied force. It was accordingly decided to do this and a British force under the command of General Sir W. Heneker, comprising 6 (and later 8) battalions, 2 batteries, and a section of Tanks, together with the necessary ancillary services was despatched. With the exception of 2 battalions from England, the whole of this force came from the Rhine where it was replaced as a temporary measure, by arrangement with the French Government, by 3, later reduced to 2, French battalions. The British force arrived in Silesia between May 31st and June 6th and was assembled in the first instance about Oppeln.

In addition to the British contingent, the Allied force comprised a French contingent of 9 battalions and 6 batteries with Tanks and Armoured Cars and an Italian contingent of 6 battalions and 2 batteries. Supreme Command was vested in a French General (Gratier) who was responsible for carrying out all military measures necessary to give effect to the recommendations of the Plebiscite Commission.

Plan for restoring order.

The plan for restoring order drawn up by the Allied High Commission was based on the formation of a neutral zone between the Polish insurgents and the German Self Defence Force. It was hoped to induce the rival forces to withdraw simultaneously by stages, thus forming the zone which would be occupied by Allied troops until the restoration of order enabled the local authorities to take over.

Apart from the military objections to this plan, which necessitated dispersal of the Allied Forces on a very extended front with few lateral

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communications, it was doubtful whether owing to feeling of mutual distrust, the opposing forces would be induced to carry it out. The alternative plan of handing over to the Germans and Poles respectively those portions of the country about which there was no question, and thus reducing the actual area of contention to a size which would enable the Allied Force to act effectively, was turned down by the French. Efforts were now made to prevent the supply of men and material crossing the border from Poland and it was hoped that this would force the Poles to moderate their attitude.

Although the Poles stated that they were prepared to accept, in principle, the proposal for the formation of a neutral zone by simultaneous withdrawals of both sides, the Germans held that this plan put them on the same footing as the insurgents. In addition the dissensions among the Allies, and the poor results so far achieved, caused the Germans to doubt their power of preventing the Poles from seizing any positions that they (the Germans), might evacuate.

Eventually however the French were induced to co-operate in the expulsion of the insurgents from several of their forward positions. This resulted in a further withdrawal of the Poles along the whole line and was followed by a withdrawal of the Germans from a salient from which the Poles feared an advance might be made. Beyond that point, however, the Germans refused to move and negotiations were resumed with a view to finding a way out of the impasse.

Ultimately Generals Heneker and Hoeffer (the German leader) in conference evolved a plan which was accepted and signed by both parties, and under which the evacuation was to be completed by July 5th.

The substance of the plan was an undertaking by the Germans to withdraw and concentrate their force as soon as an initial withdrawal of some depth had been made by the Poles. The Poles were then to evacuate the remaining territory by stages, while the German Force would be gradually disbanded, so that it would cease to exist as the last Poles crossed the frontier.

This, with certain minor alterations, was carried out, and quiet restored.

Further developments.

The Allied Commissioners, however, insisted on the necessity for an early decision as to the territorial division to be made on the basis of the plebiscite, if further disturbances were to be averted. The Commissioners, as already stated, themselves were unable to reach a unanimous decision, and, in view of their failure to do so, His Majesty's Government pressed for immediate reference of the question to the Supreme Council. but a meeting could not be arranged before the beginning of August owing to parliamentary reasons in France and owing to the sittings of the Imperial Conference in London.

The French Government deprecated the meeting of the Supreme Council and favoured the appointment of a Committee of British,

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French, and Italian experts to make a last attempt to reach a unanimous decision on the territorial settlement. Being anxious to leave nothing undone which might conduce to a unanimous decision, His Majesty's Government accepted this proposal and agreed to a meeting of experts being held in Paris, on the sole condition that the Committee should set to work at once and arrive at their conclusions in time for submission to the Supreme Council.

Meanwhile the Allied Commissioners, having failed to agree upon a solution, and not expecting an early decision of the Supreme Council, reported that a continuance of the prevailing state of uncertainty in Silesia would render necessary the despatch of reinforcements. Whilst the British and Italian Commissioners believed that if an immediate territorial settlement could be achieved, no reinforcements would be necessary, the French Commissioner urged that the despatch of reinforcements was essential *in any case*, and the French Government, whilst pressing this view on their Allies, somewhat precipitated matters by deciding to send a French Division, even though her Allies should not be prepared to send troops of their own, and, in furtherance of this scheme, demanded from the German Government facilities for its transport across Germany. The considered advice of the British and Italian Commissioners was that if any reinforcements were necessary, this should be effected by means of a mixed Allied contingent.

The French Government finally agreed to allow the question of reinforcements to come up as the first item on the agenda of the meeting of the Supreme Council, the date of which, in agreement with His Majesty's Government was fixed for August 8th. At the same time it was arranged that the French, British and Italian Ambassadors in Berlin should make a joint demand to the German Government to the effect that the latter must be prepared to facilitate transport across Germany of Allied forces which the situation in Silesia might render necessary at any moment. The French Government gave His Majesty's Government an assurance that as a matter of fact French reinforcements would not in the meanwhile be despatched. This understanding being happily arrived at, British experts were immediately sent to Paris where they discussed with their French and Italian colleagues a basis of territorial settlement.

The Committee of Experts did not agree, each nation's representatives putting up their own suggestions. When the Supreme Council met in Paris in August, no conclusion therefore was arrived at, and the basis of partition was referred to the League of Nations.

Part (iii). *The Decision of the League of Nations.*

The Council of the League of Nations referred the question to a Commission consisting of the Representatives of the Four States on the Council who had hitherto taken no part in the discussions, namely, Spain, Brazil, Belgium and China.

The Report of the Representatives was issued on 12th October, 1921, and was endorsed by the whole Council of the League of Nations.

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In the preliminary Memorandum, the Council stated the general principles by which its decisions had been governed. Being convinced that its main duty was to endeavour to find a solution in accordance with the wishes of the inhabitants as expressed by the Plebiscite, and at the same time, having to take into account the geographic and economic situation of various districts, the Council of the League of Nations was forced to the conclusion that it was essential to divide the industrial region. It realised that this division would, owing to the geographical distribution of the population and the mixture of the various peoples, inevitably result in dividing important interests and creating large minorities on both sides of the line, and consequently it was necessary to take certain measures to guarantee, during a provisional period of re-adjustment, the continuity of the economic life. This created a very complex problem owing to the density of the population, the number of industrial undertakings and the network of communications in the area. Adequate steps were also necessary to safeguard the interests of the minorities.

The dividing line is as shown on the map and is more favourable to Poland than was expected. A considerable part of the "Industrial Triangle", including towns such as Kattowitz and Konigshutte (the voting in which had been overwhelmingly German) goes to Poland, together with nearly all the more important industrial works. The award, however, is coupled with the condition that for 15 years the district shall, for certain purposes, e.g. railways, postal services, mining products, etc., be placed under the control of a Joint Committee so as to alleviate the inconvenience caused by drawing an international frontier through a district which is inextricably connected in all its parts.

The monetary system, for a period of 15 years, is to be based on the mark which will be the local unit of currency in the area.

During a period of 15 years, any inhabitant regularly domiciled in the Plebiscite area it to be permitted to cross the frontier without formalities, and certain powers granted to Poland under the Treaty of Versailles with regard to industrial undertakings, mines, etc., are to be renounced for 15 years.

In order to carry out their decision, the Council considered that it was necessary to set up, in addition to a Boundary Commission, a Commission composed of an equal number of Germans and Poles together with a President of another nationality (at present a Swiss) as an advisory organ to assist economically in the division of the country; appeals from the decisions of this Commission to go to the League of Nations. When the frontier is delimitated, a month's notice is to be given to the two parties in which to take over the areas allotted to them, and the Allied troops are then to be withdrawn and the responsibility for the maintenance of order ceases to rest with the Inter-Allied Commission.

The Allied Governments honoured the findings of the League of Nations but the effect in Germany was very serious, both on account of

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its apparent injustice when compared with the Plebiscite findings, and also because of its effect on German financial resources. The German Government resigned but was almost immediately reconstituted. Perhaps a still more serious effect was the fall in the mark which, within a few weeks, fell from 300 to the £ to 1,200.

It is hoped that the Boundary Commission's work will be finished almost at once and that the Allied troops may be withdrawn towards the end of February or the beginning of March.

So much for the story. A few remarks and comments may not be out of place :—

It has been stated that the voting on the plebiscite showed a considerable majority for Germany, viz : 705,000 to 470,000 votes. In general, as was expected, the Western agricultural districts voted for Germany, on the other hand in the South-east, (Pless-Rybnik), there was a strong Polish majority. This district is important because, though still agricultural, it contains enormous coal potentialities; of most importance was the district that was called the Industrial Triangle. Here again the total votes was in favour of Germany, but there were in some portions Polish majorities and in others big Polish minorities. The problem placed therefore before the Silesian Commission and the Allied Powers was a very difficult one. In order to carry out the instructions of the Treaty they would either have to divide the industrial district, which is really one large town, or, however they made division, a very large majority would have to be assigned to the country other than that for which they voted, and these difficulties were increased by the Korfanty rising, undoubtedly helped by Poles beyond the border.

It is important to remember that the vote included not only persons living in the country but out-voters also and that it was taken by communes and not by a common vote for the whole area.

It may be remarked that the time devoted to the question of Upper Silesia in the Peace Conference seems out of all proportion to the importance of the problem itself, but the great thing to remember is that the adoption of the plebiscite was really a political device to overcome the initial difficulties. If the Germans, when refusing to sign the Treaty, gave the cession of Upper Silesia as their reason, it would not be possible on this ground for us to renew the war and send the British Army into Germany.

It would be faulty to imagine that the doctrine of self-determination could justify the national and complete union of Upper Silesia with Poland. The Polish population in Upper Silesia is what is popularly called 'Water Poles', their speech is a dialect, a mixture of primitive Polish terms with German. The people are, to a great extent, descendants of the Slovak race which inhabited Upper Silesia before it was finally colonised by the Germans. They are really a new race, the outcome of the merging of the conquerors with the conquered in the same way that the descendants of William the Conqueror and his followers are Englishmen and not Danes. If self-determination

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be taken as the basis, it would be just as logical to demand it in any place where the poorer districts of large cities are mainly populated by a mass of foreigners.

It is interesting to consider the role of the British troops in Upper Silesia. When they first went there it was universally spread among the Poles that they were going to aid the Germans against the Poles. The latter devoted much time and paper towards propaganda among the British troops. It was not long, however, before both parties interested realised that the British came in the spirit of fair play and the popularity of British troops was very high, and the ability of a few British troops to keep in order quite a large district by their moral force was very apparent. This only confirms what we have found all over the world, in the Caucasus, in Armenia, on the Rhine, in Palestine and elsewhere, that the British troops are looked up to and trusted as single minded, as people with no axe to grind, or with no private interests to serve, and as unique in their rôle as guardians of the public peace. It is one of the most gratifying and frequently occurring faults in the history of the last few years that whatever may have been the attitude of the populace in any of these out of the world places to British troops on their arrival, there was nothing but regret and dismay on their withdrawal and departure.

It is probable that in the future the rôle of the British Army may more and more come to be that of a holder of the scales between two divided parties in a country. Consequently this trait, which is universally and long remembered by the people concerned, is of inestimable value to the British nation.

It may be relevant here to discuss the different ideas which animated the British and the French in their dealings with Upper Silesia.

The whole question turns on the establishmnet of an indpendent Poland. France, considers a strong Germany to be a danger to the peace of Europe; so from her point of view, Russia being a non-existent factor, a strong or at least an independent Poland is essential. An independent Poland needs mines, industrial areas for development, and areas from which to collect food and it was a natural corollary to suit the French view, that Upper Silesia should become Polish. This is a distinct policy, and as we know, the French are never backward in pursuing the logical outcome of their policy. On the other hand, Upper Silesia to the ordinary Englishman conveyed, and possibly still conveys, little or nothing; also, by reason of our insular situation, the state of the East of Europe is, or was until recently, a matter of only academic interest to the British nation as a whole. All these matters combine to prevent our having any definite policy. As regards Poland and as regards Upper Silesia, definite ideas were confined to the few people who had made a study of Eastern Germany, and we were, as a general rule, content either to back the policy of France, or in cases where such policy aroused a storm, to try and act as peace-makers and to try and hold the balance. This, I think, partly accounts

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for the difference and the divergences of outlook on the part of the Allies, which have been conspicuous at times in the history of Upper Silesia during the last two years.

Conclusion.

The promulgation of the decision of the League of Nations has brought us to the last phase in the question of Upper Silesia. There remains only the question of the future.

It would be rash to attempt to speculate as to what may occur. It seems probable that the boundary as demarcated will be accepted and that an attempt will be made to carry on under the new conditions. The people of the country are thoroughly tired of disturbances and wish to settle down. There is talk of a further Polish "*Putsch*" engineered by Communist propaganda with a view to increasing the advantage already granted to Poland under the recent decision, but it is more than doubtful if it will materialise.

What is of more interest is to speculate on the outcome 15 years hence. There are many who will argue that it is not possible for Poland to continue a prolonged peace with Germany. From a military point of view, the Polish Corridor and the separation of East Prussia from the rest of Germany present a situation which has no element of stability. There are military, economic and racial reasons why Germany must always work for the destruction of a united Poland. These reasons are likely to become acute when Russia begins to grow stronger. There is the further question as to whether Poland can ever again exist as an independent state. Ever since the last of the Jagellons, who were the last hereditary rulers of Poland, the Polish crown has been sold and bought by the various nations interested, and for nearly two hundred years before the partition of Poland the election of monarchs had become a scramble among foreign potentates for the lease of Poland as a military asset, backed by the nobles of the country in their eagerness to sell their country to the highest bidder. Eventually, as was only natural, the rivalry became too keen, and it was necessary for the mutual friendly existence of Russia, Prussia and Austria, that they should once for all do away with a Poland that might be a valuable hostile asset in the hands of any one of the three rivals; hence the partition. The same argument may hold to-day as held in 1780, and it would thus be only a question of time before an independent Poland was absorbed in one or other of its neighbours.

Another factor which bears on the situation, is that, in the opinion of many, it is humanly impossible to divide Upper Silesia which constitutes politically, historically, geographically, and economically a unit, without damaging the whole structure. The structure of the Industrial Triangle is most complex; competent authorities say that the Black Country and the most densely populated parts of England are as nothing to it in its highly developed organisation. What the effluxion of time and the progress of industry through centuries has combined to make into a homogeneous whole cannot be split up at the

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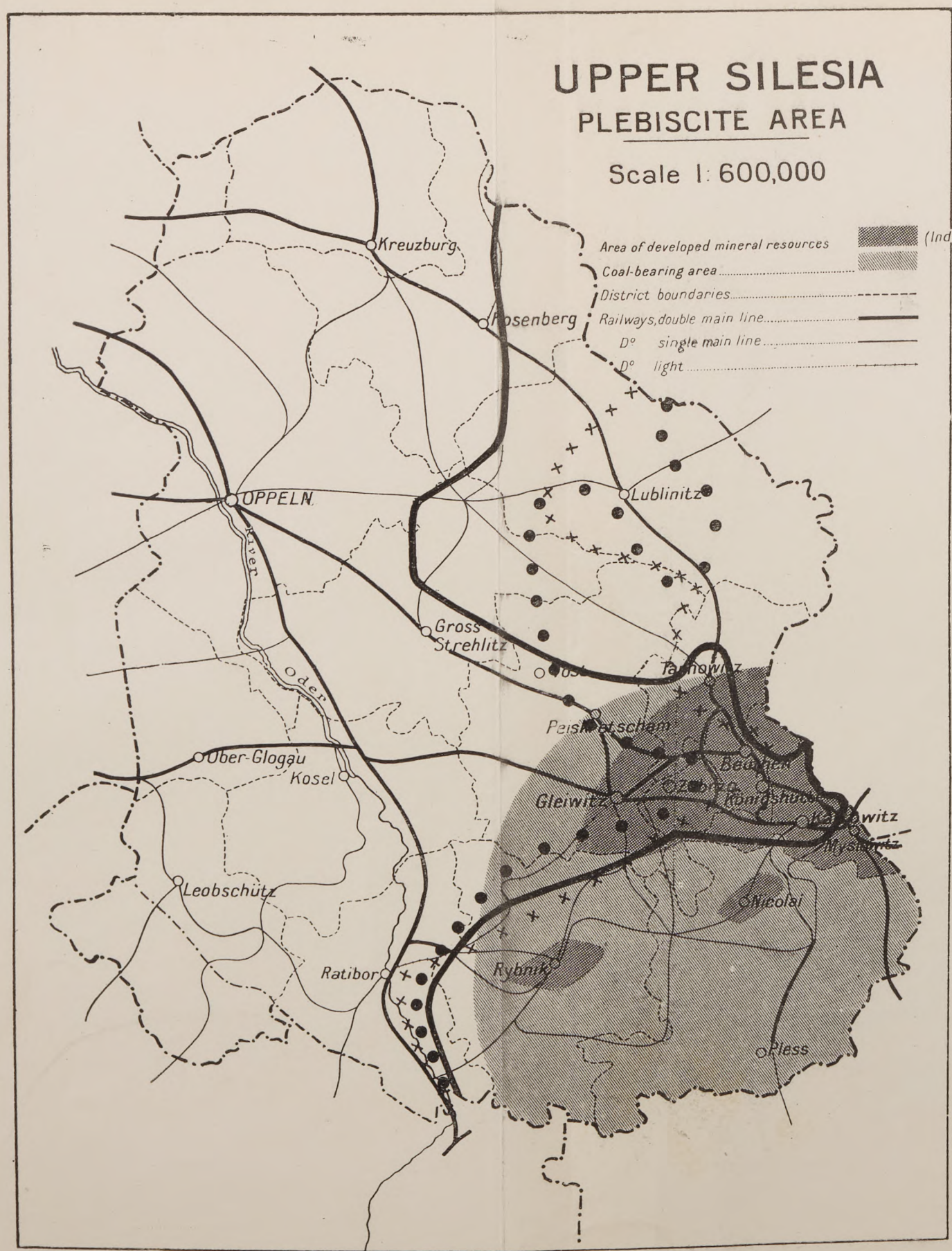
UPPER SILESIA
PLEBISCITE AREA
Scale 1: 600,000
Area of developed mineral resources (Industrial Triangle)
Coal-bearing area
District boundaries
Railways, double main line
D° single main line
D° light
Kreuzburg
Rosenberg
OPPELN
Lublinitz
River
Oder
Gross Strehlitz
Tarnowitz
Peiskretscham
Ober-Glogau
Kosel
Gleiwitz
Leobschütz
Ratibor
Rybnik
Nicolai
Pless
Final French Proposal
» British »
League of Nations line

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whim of man, into two diverse and self-contained parts. This feeling under the partition will probably grow; there is even now a majority in Upper Silesia which believes that the future of the country lies in joining Germany *en bloc*. There is a minority, not a big one perhaps, which believes that the solution is in joining Poland, but there are few people, if any, who believe that a solution lies in a division of the country. At the end of 15 years it is possible that the expression of the wish of the people will be clearly shown in the unanimous demand for junction with the German Empire."

THE CHAIRMAN: Would any gentleman like to ask the lecturer any questions?

MAJ.-GEN. LONGLEY: Are most of the upper classes in Silesia Germans?

COL. HAINING: The Germans are the educated class. The agricultural man is usually Polish. One finds that the skilled worker—such as the metal worker is German: the miner is Polish. The Germans predominate in the towns. The Poles form the bulk of the agricultural population in the South.

COL. LEWIN: What is the language that is spoken?

COL. HAINING: German, in the larger towns in the South, and throughout the North. In Pless and Rybnik, in agricultural areas, they speak a Polish dialect.

MAJ.-GEN. LONGLEY: It is fortunate that they accepted the decision of the League of Nations, and that they both went back when they were asked.

COL. HAINING: Yes. The bulk of the population seems absolutely tired of fighting, and wants to settle down—regardless of whom they come under—to their peaceful avocations.

THE CHAIRMAN: Ladies and Gentlemen, I do not propose to add anything to what the lecturer has told us about the state of affairs in Upper Silesia. The subject has been of great interest and he has dealt with matters concerning which we have not had much opportunity before of obtaining information. The preparation of a lecture of this kind entails a great deal of labour and study. I am sure we are all greatly indebted to Colonel Haining in coming down here to lecture to us. (Applause).

COL. HAINING: Thank you very much.

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LONDON AS AN IMPERIAL G.H.Q.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 14th February, 1922.

BY DR. VAUGHAN CORNISH, D.Sc., F.C.S., F.R.G.S., F.R.C.I.

Colonel H. F. E. Lewin, C.M.G., R.A. in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, it is my privilege to introduce to you this evening Dr. Vaughan Cornish, who will lecture to us on London as the G.H.Q., of the British Empire. To those of us who are still in the elementary or examination zone of our lives, he is probably well known by his book on the Naval and Military Geography of the British Empire. I, therefore, feel that in an Audience such as this there is no need for me to make any further introductory remarks, and I will, therefore, merely ask him to be so good as to give us his Lecture. (Applause).

LADIES AND GENTLEMEN: The various fortune of Capitals, some of which have decayed and others endured, cannot be understood unless we know the physical geography of the neighbourhood, the situation of the region in the world, and how the cities stood in the political map at different periods of history.

In the case of the capital, geographical relations with foreign countries are of relatively greater importance than in other cities. The capital, as its name implies, in the H.Q. of the State, the city selected by the Government for its seat, and, as the Government of a Sovereign State is charged with the conduct of Foreign as well as Home affairs, it follows that the proper seat of Government is at a common junction of home communications with those leading to foreign parts. It is a matter of history, of which I have accumulated abundant evidence, not yet, however, fully published, that the usual position of a sovereign Capital, at whatever period we examine its place on the political map, is not central but eccentric. Also, when we examine the relative importance of the surrounding foreign countries we find that the sovereign Capital is towards the frontier of the most powerful neighbouring State. As this is the principal frontier, the site of the Headquarters is properly described as a Forward Position. The transfer of the Seat of Government from one city to another which has accompanied the growth of some States, has preserved this relation to the principal frontier. A case in point is that of the Roman Empire. After expansion to the Sahara and the terminal Atlantic ocean, a premier capital was instituted at Constantinople, an eastward position at the

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junction of Europe with Asia and on the strait connecting the Black Sea with Mediterranean waters. Thereafter the Emperor of the Western half of the Roman world ruled from Milan or Ravenna, not from Rome. It should be observed that in Empires, as distinguished from States of single nationality, the capital was not advanced further than the region next to that of the dominant community.

In cases where the Government has remained seated in the same city, it will be found that the capital has been throughout in the same relative position towards the principal and subordinate frontiers. Paris is a case in point, standing in the Northern angle of the feudal empire of the West Franks when Hugh Capet was elected sovereign in the tenth century, and occupying the same position in modern France. The principal neighbours during most of that time have been the British off the North-Western coast, and the Germans on the North-Eastern frontier. There was, indeed, a time when the greatest neighbouring Sovereign was the King of Spain, but this was when the potentate who had this principal title was also sovereign of the Netherlands, and in both military and commercial relations his principal entry to France was from the Netherlands on the North, not across the Pyrenean barrier on the South.

I proceed in the light of these examples to examine the suitability of London as Capital of our Empire.

The structural relief of Great Britain conforms to the continental relations of the island, for the backbone runs north and south near the western shore, so that the longer slope, with most of the good plough land, is on the East side, facing the continent of Europe. Moreover, the island is broader and lower in the south, where it approaches the continent, so that both the greatest block of agricultural land and the best foreign connection is in the south-east.

The best corridors of entry from the Continent are the eastern and southern estuaries and the tideways of their rivers. Not until the head of these tideways is reached can the larger rivers be conveniently crossed, and upon the head of these tideways, therefore, the lines of land traffic have always converged. Consequently the cities which provide the principal connection between the British Isles and the Continental area of the Old World have always been near the head of the tideway on the principal rivers flowing to the east and south coasts.

In the study of historic capitals in Great Britain four eastern estuaries are of great importance, those of the Thames, Humber, Forth, and Tay, on whose rivers have been the Headquarters of Kingdoms. On the Thames tideway, nearest of the four to the Continent, is the old Headquarters of South Britain, which became afterwards the General Headquarters of South Britain and Ireland, and later of Great Britain and Ireland. It is now General Headquarters for the conduct of such affairs of the British Empire as are not dealt with at the Divisional Headquarters of its constituent Nations.

When Claudius decided to establish a Province in Britain, Gaul was already Roman, and the ports of Kent were therefore the landing

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places. This district, being hemmed in by a forest wilderness on the west, and blocked on the north by the estuary of the Thames, was unsuitable for the insular base of operations. This had to be at a Thames crossing, if possible on the tideway. Below the Lea the Thames is too wide to be bridged and the north bank is mostly marshy. The tide only served about as far as Kingston, and beyond Weybridge the course of the river changed to a direction which rapidly lengthened the line of communication from Kent. From the crossing of the Medway at Rochester the distance to the Thames crossings at Brentford or Kingston is only seven miles longer than to that of Southwark. The two former are good crossings with hard banks, and at either of them about five hundred feet would have been saved on the length of the Thames bridge. The pile-driving also would have been much easier on account of the smaller tide. The Southwark crossing had, however, a military advantage over those at Brentford or Kingston, for it led to the defensible district between the east-flowing Thames and the south-flowing Lea. This advantage was shared by the Westminster crossing, but that from Southwark led to a higher and drier site for a camp and city. The west bank of the Lea is a perfect line of defence, for it is dry and sufficiently high, whereas the east bank is low and marshy and was flooded by the tide. The course of the tidal river is moreover unusually straight. The principal native capitals were Colchester and St. Albans. The Lea was a defence against the former, and the country between the Lea and the Middlesex Colne a high and dry line of advance to the latter, and beyond it to the main interior, or Midlands.

London between the Tower and the Bridge became a Roman port, and from it radiated a system of paved roads which are closely reproduced on the railway map by the present trunk lines.

When the conquest was pushed on, London ceased to be in the forward area, and was consequently not the seat of the chief military command. It was, however, the chief connection of the insular Province with the Continent. As such it developed commercially, and consequently was left pre-eminent when the garrison towns, such as York and Cirencester. lost their legions.

London was never the capital of a tribal dynasty of the Anglo-Saxons, as were other cities founded by the Romans. The Anglo-Saxon Kingdoms of Southumbria "marched" with modern Middlesex, and historical evidence indicates that the city, which has always had in a special degree the character of a market, was the autonomous commercial capital of Southumbria during the Heptarchy. In the latter part of this period, when Mercia, and afterwards Wessex had the hegemony of the Anglo-Saxon Kingdoms, Brentford, under the former, and Kingston, under the latter, were G.H.Q. for the Suzerain, the place of Common Councils and in the case of Kingston, Crowning also.

Although London was largely engaged in foreign trade, the Londoners were rather Thames Waterman than seamen, and founded no navy. Thus when the Danes and other Norsemen dominated the seas, the economic foundation of London was undermined, and ulti-

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mately the Londoners threw in their lot unreservedly with King Alfred of Wessex; who repulsed the Danes by sea as well as by land. The Tower of London, with its tidal-creek, became a station of the Royal Navy, as our marine defence is still called. Wessex, London, and those lands to the north which were re-conquered from the Danes, formed a consolidated dominion which became known universally as the Kingdom of England. TheImperial affairs of the whole were not conducted at Kingston, which was replaced by Westminster, and in due course "the City", "The Borough", at the south end of the Bridge; and Westminster became united in London Town, the Commercial and Political capital of the Kingdom of England, which comprised all the south of Great Britain except Wales.

The addition of Wales and Ireland to the English Crown did not impair the geographical suitability of London as G.H.Q., but the Continental possessions of Henry II were so extensive that we must enquire why it was not replaced by a continental capital. A sufficient answer is provided by the fact that the continental districts were occupied by several communities, Bretons, Gascons and so forth, and that the English, peopling most of South Britain, were by far the largest community of the Angevin Empire.

When James VI of Scotland succeeded to the English crown he transferred his Court to London, and about one hundred years later London became the sole Parliamentary capital of Great Britain. York would have provided a connecting position for the Government of the united Kingdoms of North and South Britain, but, as usual throughout history, the foreign, not the domestic, junction of communications was preferred.

From the position of early capitals in Great Britain we gain a valuable indication of the causes underlying the allegiance of the Northermost Anglo-Saxon settlement to the Scottish crown. Had the men of the Lothians wished to be Englishmen they had opportunities, particularly in the time of Edward I. The deciding factor in the Wars of these times I take to be that the Anglo-Saxons beyond the Tweed had never become English in the national as distinguished from the linguistic sense of the word, and had long preferred to be Scottish. It should be carefully noted that between the Anglo-Saxons of the Lothians and those of Southumbria there interposed a Danish Kingdom, capitaled at York, which provided a good connection with the Continental base of the Danes. This city was captured by the Danes in 867 A.D., it was not until 948 A.D. that the rule of the last subordinate Danish King was ended, and before the end of the century the Danish Colonists in Yorkshire had attached themselves to Sweyn of Denmark. During a considerable part of this period the Danes capitaled at York were heathen, whereas the Scots, capitaled since Kenneth Macalpine at Scone, near Perth on the Tay, were Christian. In this connection it is essential to note that the Christianity of the Lothian Anglo-Saxons was originally identical with that of the Scots, being Patrician and Hibernian. The whole inspiration of the Celtic

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mission work, which produced the early literature and art of Northumbria, was entirely different from that of the organising priesthood sent by Popes to the courts of the Heptarchy. When we note also the geographical circumstance that communication between the Lothians and the neighbourhood of Perth is much closer than with York we have a summary of the chief causes which grouped the Anglo-Saxons of the Lothians about a northern capital.

The final advance of the Scottish capital to Edinburgh placed it in the principal agricultural storehouse of its Kingdom, on the side connecting this with the chief insular neighbour, and close to the great estuary which is the best connection of North Britain with the Continent.

The similarity between Edinburgh and London in surroundings and position as related to the two Kingdoms of North and South Britain is obvious from the map. But the agricultural district within which London stood was on a very much greater scale, and the English community must have been correspondingly greater than the Scottish in the time of James I and VI. The map of the population of Great Britain c. 1701 shows a solid block of nineteen counties around London each with a population of one hundred and upwards to the square mile, and no other counties with an equal density. The three corners of this populous part of the island were Kent, Somerset and Norfolk.

The industrial revolution brought about by the use of steam-power, and the consequent development of the coal-fields, has shifted the centre of production and the seat of greatest population to the district which lies between the line connecting Bristol and Hull and that joining the estuaries of the Clyde and Tay. The increased speed of transit and the instantaneous methods of transmitting messages which have come in with the age of mechanical invention, have, however, so linked London with the coal-fields that the proposal to shift the capital to some place among the factories has only been an idea to play with, not a practical proposition.

In passing from the consideration of London as capital of the British Isles to that of London as capital of the British Empire I shall have to introduce the word "Metropolitan" as descriptive of that district or country of an Empire whose Divisional H.Q. is used also as G.H.Q. Using Metropolitan in this sense, we have to answer the question; do the British Isles by their resources and position satisfy the conditions which history shows to be typical of the Metropolitan Region of a Great Power, bearing in mind that Great Powers, for which Empire is a general name, have always been complex in their political or national constitution, or in both.

Racially, the British Empire is composed of the European and the coloured peoples, of whom the former (using the 1911 census) number about sixty-one million, the latter something like four-hundred million. At present the Empire is mainly defended by the White people, of whom three-quarters are in the British Isles. The block of territory next in White population is Canada, whose people only number about one-sixth of the population of the British Isles. Thus

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the British Isles are still the principal home of the dominant stock of the Empire, and there is no discernible cause which can reverse this condition for very many years. The exports from these islands, in the last normal years, those immediately preceding the War, were far greater than from any other part of the Empire, owing to the development of mining, manufacture, and carrying trade. They are, therefore, the headquarters of the Empire's industry, so that it only remains to enquire if this Headquarters of the White people and of industrial production is situated in relation to the domestic communications and foreign approaches of the Empire in the manner typical of a Metropolitan region.

If we look only at the large blocks of British territory they seem to belong equally to the Atlantic, Indian, and Pacific Oceans, but when we note the harbours in insular and peninsular positions which connect them up, we see that the British Empire is not linked across the North Pacific as it is across the North and South Atlantic and the Indian Ocean, and along the Mediterranean and Red Sea. The British Empire grew by expansion oversea East and West from the British Isles, until the coasts of the Pacific were reached from the opposite directions, and such having been the direction of its growth, the position in the North Pacific which dominates communication between British Columbia and Australia, the Hawaiian Islands, was not acquired, and has become a principal naval station of the United States. Again, whereas the British Isles and the British naval station at Gibraltar flank the approaches to the maritime communications of the Empire from most of the European ports, the great-circle course from Vancouver to India *via* Singapore is closely flanked by the long chain of Japanese harbours. Physically, therefore, the British Empire consists of a number of great blocks of land from Australasia, in the South-East to Canada in the North-West linked by stations in the Indian and Atlantic Oceans and in the Mediterranean. There is also a guarding fringe of stations in the Western Pacific and Western Atlantic.

If now we examine a map in which the tonnage on the trade routes is indicated by their breadth, we shall see that the English Channel is the greatest focus of shipping. If we look at a map showing the hemisphere which contains most of the land we shall see that its centre is near the English Channel, so that the British Isles are more central for the world's ports than any other part of the Empire. When we examine the orographical, or relief map of the world we see that the Atlantic ocean, on the fringe of which the British Islands lie, has broader and flatter slopes behind it than the Pacific or the Indian ocean. When we examine a map of railways, which, better than any other, serves to indicate the combination of dense population and economic efficiency, we see that their greatest radiant is near the British Isles in the Continental Countries of Western and Central Europe. Finally, if we look at the grouping of the foreign nations which have great military potentiality, we see that four of the six are based in Continental Europe.

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It is therefore clear that the harbours of the British Isles form a good junction of the domestic communications of the Empire, and that the English Channel and the Northern exit from the North Sea are, together, the principal foreign approach to these communications. Thus these islands occupy the geographical position in the Empire which is historically typical of the Metropolitan region of a Great Power, that is a common junction of home communications with the principal foreign approach. Looked at more in detail we observe that it is the Irish harbours which stand at the junction of the domestic communications of the Empire, those of Great Britain which face the principal foreign approach. Under the recent arrangement military communications with the Irish harbours will not be in the hands of the London War Office, and armed vessels may be maintained in Irish harbours which will not be under the orders of the London Admiralty. This degree of separation of naval and military control is similar to the mutual independence in naval and military matters of Canada and South Africa, or South Africa and Australia; but geographically the cases are not alike, for Canada, South Africa, and Australia, do not flank each others communications. To have one H.Q. controlling the principal junction of communications between the parts of an Empire and another H.Q. the principal foreign approach is an innovation in the history of Great Powers. Geographical connection however resembles the force of gravity; it never ceases to exercise a steady pull, and it is doubtful if conventions will really hold apart the component parts of a double-island which from the character of their resources and their relative position are inter-dependent.

THE CHAIRMAN: I notice that the audience has appreciated the great interest of this Lecture as much as I have. There has been much food for thought in every sentence which Dr. Vaughan Cornish has spoken, and I feel quite sure that many here will have points which they would like to have further elucidated. If there is any gentleman here who wishes to ask any questions, would he kindly do so now so as not to detain our Lecturer longer than necessary.

As nobody else seems to be coming forward, there is one point on which I should like to ask for a little further elucidation. With regard to the typical characteristic of all Capitals, their forward position in the Empire, Dr. Vaughan Cornish mentioned that in 1914 it was pointed out that Paris was unfortunately situated because of its forward position. In 1914 the belligerent countries of Europe were not subject to Air attack to any great extent, and the functions of Government could go on irrespective of the mild air attacks of those days. Since then, however, aerial warfare has developed so immensely, and is developing every day, that the chances are that all Capitals will be subject to aerial bombardments such as were never known in the last War. We have had experience of them in London and I suppose we were all at the end of the War hoping that the Germans were going to have an experience of it too in Berlin. Attention has been drawn to the danger of this attack by no less an authority than the Chief of

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the Imperial General Staff, and nothing that has taken place at Washington has led us to suppose that such attacks will not be prosecuted by all powers. Therefore this forward position of the Capitals will now bring them into what we might call a very forward position, in fact right into the zone of operations, in a future War, and I would like to ask whether, in light of what they may expect, it will be possible to carry on the administration of a country from a Capital in such a forward area as say Paris or London, opposed by a European enemy in any proximity to them.

Dr. Vaughan Cornish: There has always been this limitation with reference to the forward position of the Capitals; they have always been kept out of the reach of tip and run warfare from the frontier. They were placed in a forward position but not so near as to be within reach of mere raids. An excellent example is that of Aix la Chapelle as the Capital of Charlemagne. Charlemagne had been seated in Paris and then he decided to spend his life in subduing the Saxons who were the remaining German Nation not under his rule, and in order to carry on his life's work, he moved his Headquarters forward from Paris to Aix la Chapelle. He did not move his Headquarters forward to Cologne. The actual position which would have been convenient for the crossing into Saxon Territory was Cologne where he still had the use of the Roman Bridge which had not then been destroyed by the Northmen. But he did not go as near as that but put his Capital at Aix la Chapelle out of reach of raids.

Undoubtedly this development of aerial warfare does put the Cities in Europe unpleasantly near the Frontier. It was noticed that during this War—one does not know how long it will be before the next War or how much aircraft will be developed before the next War, but it is quite certain that as long as the distribution of population of the Empire is anything like what it is at present—that is to say for a very long time to come—the Capital of the British Empire must be in the Island of Great Britain. Will it be much use going into the Midlands to get out of the way of the aircraft? I presume that every part of England unless it is adequately protected with aircraft of our own, will be bombed.

With reference to the position of Paris at the beginning of the War during the German advance, I said that we heard people saying that Paris was badly placed, but I do not altogether endorse what they said, because you may remember that though it was thought likely that Paris would be overwhelmed in the German rush, it was not overwhelmed, and as far as I understand what happened in the first part of the War the sudden set back of the Germans was largely due to the fact that French Armies concentrated rapidly on Paris and helped to roll up the right wing of the Germans. The reason they were able to do that was because, having the Capital in a fairly forward position, the roads and railways of France are focussed on that forward position, and, therefore, the French were able to concentrate for the repulse of the Germans with a rapidity, security, and effectiveness

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which would not have been possible if their capital had been for instance at Bordeaux with all the roads leading in the wrong direction.

Colonel Broad: I should like to ask the Lecturer if he can tell us a little about how he regards the growth of America and its effect upon the position of the Empire. The growth of America is historically quite a modern event, and, therefore, probably, is only in its infancy, and it is possible that in course of time the centre of trade, finance, communications and everything of that kind may shift over into America from Europe.

Dr. Vaughan Cornish: I do not think that the population of the New World can ever be as big as that of the Old World, as it is only half the area.

With regard to the British Empire, Canada has the greatest area of fertile land in the Temperate Zone of any Country of the Empire, and will probably become the greatest centre of population in the Empire, and when that happens there may be a shift of Capital, but it cannot happen for a very long time. The number *added* to the residents in Great Britain during the last thirty years is equal to the whole population of the Canadian Dominion to-day. I do not think that this increase of population in Great Britain is sufficiently impressed upon people's minds. For a long time past the increase of population in Great Britain alone has been something like 3½ millions every ten years, and it is not a diminishing rate of increase except during this last ten years when the War has intervened, and in spite of the toll taken by the War, we have very nearly two million more people in this Island than we had in 1911. In order to think clearly on the subject of military geography one must memorise the round figures of population (the millions only) otherwise we do not really master the map but allow the map, which pictures areas, to mislead us as to the centre of gravity of national affairs.

General Evans: I should very much like to ask a question. You say, Doctor, that our population is continuing to increase, and you have also just told us that we must not look too much to the size of the other parts of our Empire; but, of course, the first thing which strikes one is that that size does give a means of escape to some of our surplus population. Does it come under the heading of Military geography, however, as to how your politicians should guide the working classes with regard to emigration? I take it that the working class population really is increasing more than the other, and it is just as well to consider the fact that if there is not very much room for us in this country, we are all likely to go elsewhere.

Dr. Vaughan Cornish: One question no doubt of great importance is how long can the population of Great Britain go on increasing as it does at present, and how long will it be possible for more people to earn a living here? As far as I can see if the standard of intelligence and determination of the bulk of the people of all ranks or classes becomes anything like equal to the standard of intelligence among the better specimens, I see no reason why it should not be perfectly

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possible to develop the manufactures of this country so as to provide a living for a great many more people than are here now, but, even so, large emigration is sure to continue.

Some will go to Australia or New Zealand or South Africa; others to North America. It is open to those going to North America, to choose Canada or the United States. The economic conditions are not very different, the climate is not very different and both countries in normal times, are good for making a living, provide personal freedom, and use the English language. A very large proportion of the emigrants from Great Britain have been in the habit of settling South of the Frontier, and it would be a proper exercise of judgment for the Government and all public bodies and all patriotically minded people to put it before those who are going to North America, that it is their duty, except in case of urgent private interest, to settle on the Canadian side of the Frontier. It is well to remember that every man who chooses Canada instead of the United States counts two in the relative strength of the two Empires.

Some day Canada will have as many people as the United States now has, and it is vital to the future of our Empire that then Great Britain and Canada should think alike. There are two great sources from which Canada is being peopled, Europe, including Great Britain and the United States. The people flow into Canada from both sources. The people who have gone into Canada from the United States according to all accounts make good Canadians, and that is a thing to be very thankful for, but if Canada can be predominantly peopled direct from here, then its sentiment will be more distinctly British, nearer to our own in this country, than if it is peopled by those of similar stock who have resided perhaps for generations in another country.

Chairman: With regard to that, I understand that the population of America being about 81,000,000, of that only 18 millions are of Anglo-Saxon stock. Could you in any way say what the proportion is in Canada? Is the proportion of Anglo-Saxon stock in Canada greater than it is in the United States? Can you help me about that?

Dr. Vaughan Cornish: The French Canadians are mostly confined to a relatively small area in eastern Canada. Most of the Dominion is English speaking and here I should say the proportion of Anglo-Saxon stock is, very large. I think 18 million is too low an estimate for the Anglo-Saxon stock in the United States, but the proportion of Roman Catholic Irish to Anglo-Saxons is very much larger than in the British Isles or in Canada.

Colonel Broad: In your Lecture you stated that one of the chief causes of the permanence of the Union between England and Scotland lay in the fact that there were two Anglo-Saxon peoples separated by Danes and when this barrier was removed they fused and came together. Now, we have an emigration of people from this country both to Canada and to the United States: Can one argue from that at all the future fusion of the whole of North America?

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Dr Vaughan Cornish: In 1911 the American Republic offered Canada commercial union, and Canada emphatically declined. The solidarity of the Canadian divisions in a Canadian Corps under a Canadian commander has further strengthened the individuality of Canada. Some day there may be close co-operation in all the communities of the English speaking world, but from what I have seen of the United States, and of Canada, and of the Canadian Corps in France, I do not think the Canadian Frontier will ever fuse, as long as Nations exist.

The Chairman: Time is getting on and unless anybody else has any very burning question to bring before the Lecturer, I think it is perhaps time that I should merely voice your thanks to him for the very interesting lecture which we have heard. I am sure that those last two Maps which were thrown on the screen showing the railway systems of the world and the water systems of the world were very heartening to any Englishman or Britisher. They decidedly show us that there is life in the old world yet and in the old country. We, apparently, are well placed for what lies in front of us, and I am sure most of us will go away from here to-night with a feeling of optimism and hope for the future and very deep thanks to Dr. Vaughan Cornish for so ably laying the matter before us and giving us this very interesting lecture and comfortable thought.

I wish to thank you very much. (Loud and prolonged Applause).

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CAN CAVALRY BE DISPENSED WITH ?

Translation of an Article by Gen. Robillot in the "Revue Militaire Générale," of January, 1922.

Translated by

BRIG.-GENL. W. EVANS, C.M.G., D.S.O.

Introduction by translator

IN these days of new arms, in the interest aroused by their development the requirements of older arms are apt to be overlooked.

Take our own arm as an example. Although the power of the Artillery has developed since 1914 beyond all recognition, yet there are people who think of aeroplanes and tanks as weapons that can replace artillery, whereas in reality they only add to its power—It is a mechanical age, and the horse is being replaced by the motor for many purposes—There are however certain tasks that the horseman alone can carry out, though here again his efficiency is helped enormously by aviation, armoured cars, and light tanks.

On the Western Front after the early days of 1914, we were fighting a war of positions up to the very end, and the use of Cavalry, as Cavalry, was very little thought about, or talked of, by us in the line.

An article by Gen. Robillot in the "Revue Militaire Général," of January, 1922, goes into the question whether Cavalry should be retained or not in the French army, and I venture to make a rough translation of a part of his article, in the hope that it will interest, and enlighten officers of the Regiment.

TRANSLATION.

The scheme for the reorganisation of the Army, just submitted to the Chamber, will once more bring to the fore the question of the fate of the Cavalry.

Articles have been written, not always in a very temperate spirit, since the war, for and against its retention. The schemes, official or otherwise, published dealing with its organisation do not appear to have sufficiently enlightened those who will be called on to decide its fate.

It would appear then to be an opportune moment to discuss this question again with an open mind. Do we require Cavalry? And if so, what should its strength be, and how should it be trained and organised in War and Peace?

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Such is the problem I shall try to solve, my only object being to rouse the general interest of the Army.

In these hard times it is inexcusable to retain an arm on account of *its traditions*, unless it fully justifies its existence. Services in the past must not be considered. Cavalry should be retained only if it is capable of carrying out tasks for the development of operations in war, which cannot be carried out at all, or as efficiently by other arms. Thus the problem becomes: Are there tasks that arms other than Cavalry are unable to compete with?

Protection of Mobilisation—Reconnaissance.

On the outbreak of war, the C.-in-C., has to insure mobilisation, and concentrations of troops being uninterrupted by the enemy. That can only be done by looking for the enemy and finding where he is.

To what arm do we look to to carry out this mission.

Some very brilliant officers say—The Air Force—In their confidence in this new arm they are somewhat premature.

Airmen can see only by day, in good weather, and when the clouds are high. The search for information and the security afforded by it, cannot be dependent on weather conditions. Even in good weather, the mastery of the air allows aviators to see only what the enemy allows them.

The Germans have taught us that fact by their concentrations of troops for the 1918 offensive, more especially that near the *Chemin des Dames*.

Moreover to spot concentrations is not enough. You must have identifications either by taking prisoners, or documents.

Until the day arrives when the *helicopter* can raise an observer, and maintain him in a stationary position, the air can provide only incomplete information, if it can provide any at all.

Others have suggested reconnaissance by detachments carried in motors. Even now these machine gun cars, as they are tied to roads must be screened. If you send them out into the "blue," they are at the mercy of the enemy.

The Tank too must not use the roads. Although its normal progress is across country—yet its radius of action is limited.

One arm only, at the present time, Cavalry, can go quickly and far afield properly armed for fighting and obtaining information.

Cavalry alone can look after its own safety and if necessary that of the troops told off to support it—can fight and take prisoners. The air, and wireless telegraphy allow the information it gains to be sent back almost instantaneously.

It is not enough to get information, you must *protect*.

Whatever the weather conditions, cavalry by itself can not only assure the security of our mobilisation, but also can hamper that of the enemy and force him to effect his concentrations further back. Our high command is so convinced of this, that some months ago when the occupation of the Ruhr was anticipated, a Cavalry Corps was

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at once formed and pushed forward. The methods of fighting, and the mobility of the Cavalry enable that arm to act boldly, and to fight far from supports, without risking anything.

When people say to me "security will be assured by holding the Rhine", my reply is we shan't always have that ditch to make use of—that passive defence is a bad protection—that protection only is not enough—you must harass the enemy, and strike at once at his forces and his moral.

That, if under certain conditions aviation can fulfil these missions, we know from our own experience at the front in bad weather how little we were annoyed by the air—so that I conclude by stating that sooner than trust to the Air Force alone, I want guns, machine guns, armed cars, and the support of the light infantry of divisions and of the Cavalry Corps.

Protection.

The concentration of our Troops is completed. Armies are moving forward and are manœuvring. How is their security arranged for in view of the approach and manœuvre of the enemy? By Infantry? That arm cannot be pushed forward alone, besides its advanced troops can only gain ground if the main body remains immobile, or halts.

By Aviation? It is not enough to be warned of the approach of the enemy. The army must march, and rest, up to the last possible moment, undisturbed.

If aviation can guarantee comparative security from the air *Cavalry* by itself can retard the advance of the enemy, and keep them at arms length from big and small formations. The question becomes —"Will Cavalry hand over this task to The Air Force, Tanks, Auto Canons, or Light Infantry?"—Certainly not; but Cavalry will always give these arms the chance of acting under favourable conditions.

Operations against the Flanks, and rear of the Enemy.

Contact has been obtained and the battle is commencing.

The battle is not going to start all at once on a continuous fortified trench line. Between armies and groups of armies there will be gaps. There will be flanks more or less vulnerable. Communications that can be attacked.

How are we going to threaten these flanks and communications.

Against the flanks *Infantry* covered by mounted troops will do.

Against communications—*Cavalry* alone in all conditions, *The Air Force* by day and in good weather can act effectively beyond the range of our Heavy Artillery long range guns.

Aviation without limit of range can hamper the movements and communications of the enemy—but they never have been able to interrupt them for long.

The *heavy artillery* can only deal with the areas immediately behind the battle front. Aviation acting by night bombardments will have its task made very much more difficult now that aerial defence is so much more perfect, and acting by day its effect will be more moral

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than material. Until a battle front becomes continuous, and while there are flanks uncovered, there is only one arm quick enough, and with sufficient fire power to threaten them, or to cut seriously the enemy communications and that is *Cavalry*.

Do not let us be frightened by those who believe it runs great risks when far distant from other arms. While Cavalry has space it only risks the consequence of its own mistakes, or meeting an equally well armed enemy Cavalry.

We have nothing to fear if the Cavalry of the future realises this and is trained to deal with such eventualities.

Moreover, this is not merely all *theory*. The Cavalry in 1914 and in 1918 in the East, and the German Cavalry in Russia, and in Rumania showed what they could do, when hurled boldly against the enemy's rear.

Intervention in battle. The Corps Cavalry.

Meanwhile the battle develops. The fronts of certain infantry divisions are reinforced, others are thinned out, or extended. Lateral communications, or to the rear are threatened. Signals cannot be seen, and telephone wires are cut . . . . infantry is beginning to feel cut off.

What arm will give the infantry confidence, by obtaining touch, restoring communication and filling gaps. Tanks? Certainly if they are there, for the time being in any case and if the ground is favourable; and if not? once more Cavalry—Not Cavalry Corps and Divisions, but the Cavalry allotted to Corps and the divisional squadrons, always provided they are strong enough and well enough trained in manœuvre to live in the shelled area—provided above all that their strength is not squandered in countless little jobs such as escorting prisoners, baggage guards, acting as *runners*, because they can go quicker on horseback, and provided that *trench warfare* does not commence after the first few days of the next war.

The Cavalry Strategical Reserve.

War continues; the initial battles have not had the decisive result looked for, i.e. the overwhelming of one or more armies and the dislocation of the enemy's power of strategical manœuvre; the fronts become stabilised, and entrenched; the reserves are put in, and are weakened, the possibility of a break through becomes apparent, then imminent, and let us anticipate the worst: After the long battle the EVENT *(Napoleon's événement) arrives.*

As in 1918 the railways and main roads will do their best to bring up reinforcements and the General Reserve. That is not enough! What more can be done. What arm will be capable of dealing with the crisis?

As in 1918 the Cavalry alone, without entraining, without having to use roads blocked by traffic, using side roads, going across country when necessary, can arrive in time with all its weapons and ready to join the fight at once.

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Without neglecting to water and feed the horses, or rest them and the men, Cavalry can march 80 kilos. a day for several days running; it is *par excellence* the Strategic Reserve, and has proved that fact.

Cavalry in Pursuit.

At last the war, or one phase of the war, draws near its close; Pressed by our troops the enemy armies retire, weakened—either in disorder if the infantry and artillery battle has been decisive, or to avoid being pinned down, to find support from new positions, to rally and reinforce if the battle has not disorganised their troops.

What arm can turn rout into disorder, can overtake and engage retreating troops, can delay them and force them to fight before they are ready,—and after the decisive battle pursue them relentlessly, and complete the victory?

Can Infantry? It can only march at a slower pace than the enemy who is trying to escape it. The Infantry have won the battle—they cannot exploit it.

Can the Artillery—Not alone.

Can the Air Force? Its harassing power, and bombardments are not at the present time powerful enough to stop or destroy and army in retreat.

Can troops carried in lorries, or Tanks? The destruction of the roads will always hold them up. Armoured cars can only get good results when supported by Cavalry. In this case as in the others, Cavalry is the only arm quick and strong enough, and independent enough of roads to overtake and grapple with the enemy, and convert defeat into disaster.

Cavalry v. Cavalry.

In this rather lengthy disquisition which I have considered necessary to make clear the reasons for retaining Cavalry, I have not taken into consideration the intervention of the enemy's Cavalry. Will it no longer exist? If our logic, based on facts that have occurred, and on common sense, is sound, surely the enemy, whoever he may be, will take the same view as ourselves. We must conclude that the enemy will keep a force of Cavalry equal to ours and employ it in the same way. We must therefore consider the possibility of employing ours to meet and fight the hostile Cavalry to prevent its being made use of against us in the way we would wish to use ours against the enemy. Here then is another task for our Cavalry and another reason for its retention.

How would the "Race to the Sea" in 1914 have ended if there had been no French Cavalry, and the German Cavalry had been able to get round the left flank of our armies and had cut our railways and roads on the Somme, the Canche, and the Authie?

What would have happened when the French and British Fronts were broken in 1918 if the enemy had possessed Cavalry?

Gen. Robillot now goes into questions affecting strength, organisation training, arms, etc., and his reasons for writing this article.

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EVOLUTION IN OFFENSIVE METHODS.

Lectures to Swiss Officers by Lieut.-Col. of Artillery H. Corda, Chief Instructor in Tactics and Military History at the School of Artillery, Fontainebleau.

Translated from the *Revue Militaire Suisse*.—April,1921.

PART I. CONTINUED FROM MARCH JOURNAL.

To renew and to vary these attacks without respite. Never losing the benefit of the factors of surprise, speed, and superiority of material till weakness and disorganisation show themselves.

To prepare from that moment the development of attacks and pursuit.

An offensive action may comprise *several* successive or simultaneous *attacks*, each attack being itself of several days' duration, and including several phases. But when offensive action comprises the development of several attacks, the intervals of time which separate them must be reduced to a minimum. The attacks must succeed each other with but a few days' interval; and it is for this reason that each attack will as a rule be given no more than the capture of a single enemy position as a task. The essential conditions of success are—

1. Superiority of force.
2. Complete preparation.
3. Surprise.

This is the problem clearly set throughout the whole of the Memorandum.

In addition to the *superiority of means* otherwise described as power, and the complete *preparation* which are in any case two essential conditions for the success of an attack, we must seek out above all, *surprise*, and thereafter swiftness in bringing our forces to bear and speed in execution. For *surprise and speed in execution*, are not these what were lacking in our offensives from the outset of the campaign?

In view of the form that the war had taken it was evidently less easy to make use of the factor of surprise in 1917 than in 1806. And yet it was more necessary than ever, since an attack that designed to break an undefined and continuous front was certainly doomed to failure if the enemy forestalled its preparation. It is true that since the commencement of static warfare, the higher command had repeatedly in many Notes or Memoranda bearing on attacks, never ceased to draw the attention of units and formations to this question.

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In actual practice the effort to bring in superior force to the exclusion of all else had tended to make us neglect the factor of surprise to a certain extent, because there are in these two, certain materially contradictory conditions.

Force, that is to say superiority of strength, implies considerable material and preparations which last for months, and which leave their mark on the ground, and consequently inform the enemy if not of the actual moment, at least of the probable zone of a great attack. *Surprise*, on the contrary, calls for the most rapid and secret co-ordination of all these immense means, as armies have at their disposal increasingly numerous methods of intelligence, which are accurate and impossible to counter.

It would be in vain to provide the whole front with roads, railways, spurs for super-heavy guns, battery emplacements, telephonic network; the enemy would always find a hundred ways to ferret out the offensive intentions of the adversary from the moment that they began to show themselves in a prepared sector which up to then had been quiet.

Besides espionage, the necessity for the final preparation will give him the information; activity on the roads and railways, more artillery registration, new wireless stations, etc., and above all the question of secrecy is involved, which is so difficult to keep when several hundreds of thosands of chatterers and indiscreet persons must take part in such an operation.

Cambrai and Riga.

Two operations carried out towards the end of this same year 1917 only confirmed our higher command in this line of thought. We speak of the operations of Cambrai and of Riga, of which the leading points are pretty well identical; concealment up to the last moment of the real point of attack; speed and complete secrecy of preparatory measures; a short violent artillery preparation; employment on a large scale of comparatively new material means (gas shells at Riga and tanks at Cambrai).

At Cambrai on the 20th November, thanks to the employment of 360 tanks brought up under cover of fog, two British army corps without the slightest artillery preparation, and without having alarmed the enemy in the least degree by movement of troops, threw themselves to the assault of German positions and overwhelmed them on the first day to a depth of 9 kilometres.

Never had we been so near a complete break-through of the enemy front on the Western Front. But as exploitation had not been prearranged, this astounding success remained barren. The lesson learnt was none the less clear : the tank (or assault car) which was recognised to be but the true accompanying artillery of the infantry, emphasised itself as the prime weapon of surprise. At Riga on the 3rd September, it is true on a still more restricted front, only 4½ km., General von Hutier completely overwhelmed the Russian positions, thanks to a complete surprise effect, and to the intensive use of gas-shells. It appeared thus to be proved that long artillery preparations calculated

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for the destruction of the greater part of the defensive works, were not essential to the success of attacks, and that these attacks could succeed without any artillery preparation at all, or after one of very short duration designed for neutralising fire (counter-battery work).

Development of ideas about the defensive towards the end of 1917.

These two operations deeply stirred military opinion since at the first glance they seemed staged on a new plan, for it seemed very probable that the Germans would apply against our front an amplified form of the experimental tactics successfully carried out by them on the eastern front. One could no longer lay down as a law that one could always reckon on being warned in time of a sudden offensive of considerable extent, and it became necessary to recognise that against the power and the abruptness of the methods employed, the defensive could no longer avoid with certainty the breaking of its fronts, at any rate as far as the front line was concerned. The most it could do was to hope to prevent the enemy from exploiting first successes, and above all from capturing neighbouring positions by attacks from the rear.

During the end of the winter of 1917-1918, various new Instructions emanated from G.Q.G. to guide the armies, in view of the great defensive battle which everyone foresaw, and these modified but slightly the teaching of the Memorandum of 20th December, 1917.

The idea underlying these doctrines is that one must be prepared to fight the battle in a deep and previously-arranged zone; one should only devote to the defence of the first position the necessary means to break or at least to check the first enemy rush, and to guarantee in all cases the concentration of the main body upon the real battle position.

This position where the battle will be fought is defined for us by the line of resistance, that is to say, the line on which the enemy must be stopped at all costs, and of which the safety must be guaranteed, and which will be chosen in such a way that the enemy will not be able to attack it except after having suffered a previous disorganisation of his attacking formation. In short, the ground between the line of resistance and the front line forms the margin of safety on which the army command relies to enable it to bring up the bulk of its forces into the battle, and the infantry divisions which are in the line at the moment of the enemy attack are in reality entrusted with the task of covering the position.

Thus the enemy assault will not necessarily be stopped by the front line nowadays, but by another one behind it, (the line of resistance) which is unknown to the attacker. In this way we oppose the defensive surprise to surprise in the offensive. These principles, born of the genius of General Petain, were destined to be brilliantly and definitely justified in the defensive battle of the 4th Army (Gouraud) in Champange on the 15th July, 1918, a battle in which the last of the great German offensives spent itself, and one which was for us an undoubtable victory; but our higher command had not been

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content with planning only the counter-stroke, but slowly and patiently forged the weapon of the final offensive of liberation by guiding the troops with even more determination than ever to seek for and ensure surprise in the attack. We shall see how this was done.

PART II.

The Effort to Obtain Surprise

Translated from the *Revue Militairé Suisse*.—May, 1921.

Surprise is of a "strategic order" when applied to the general direction of operations, that is to say when the offensive is launched in a region where the enemy cannot, either carry out a counter manœuvre, or bring up his reserves in time to be effective.

It is on the contrary of a "tactical order" when the enemy is taken by surprise by the exact choice of the moment and the front of attack, and when he is overwhelmed by the rapidity of its execution.

It should be noted that even if the former is not effected, the latter often is, by the fact alone of the suddenness of the assault at zero hour, which always occasions a certain degree of surprise even to an enemy who has been warned of the attack.

Example : At Malmaison, in Artois, as in Champagne, 1915.

Further example : The opening of the battles of Verdun and the Somme.

As a general rule surprise is effected :

(1). *By seizing the initiative* which creates situations instead of accepting them strikes at the moral of the enemy and paralizes his actions.

(2). *By observing secrecy in operations*, that is to say secrecy with regard to their preparation, this secrecy should be respected by the commanders throughout the chain of command and impressed upon their subordinates.

(3). *Finally, by the rapidity of execution.* But there is more; surprise can be prepared by a number of minor methods of the utmost importance, which our instructions of 30th October, 1917 laid stress upon, and of which the principles are as follows :

1. *The preparation of surprise. Impose and demand secrecy throughout the chain of command, and the avoidance of anything which may attract the attention of hostile espionage.*

At Cambrai, as at Riga, this essential preliminary was materialized almost entirely, thanks to the following measures :

The clever spreading of false information.

Holding attacks carried out on fronts other than the front of attack, either by artillery action, or by movements of troops and dummy works.

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Removal of all distinguishing marks enabling units to be identified.

Preliminary orders copied by Officers, and distributed solely to officers.

Attacking troops and those in the line only warned at the last moment.

Employment of very discreet officers on reconnaissance work.

Prohibition of routine telephonic communication for 10 days before the attack (Cambrai) or at less than 1 kilometer from the lines (Riga). Exclusive use of cipher.

Testing of telegraph and telephone lines by A.H.Q. technical experts.

Strict censoring of correspondence (under open cover), or even suppression of same.

Supervision of relations between troops and inhabitants.

Stoppage of leave.

2. *The preparation of the battle zone should be undertaken well in advance or not at all according to the organisation of the offensive.*

At Cambrai the English were able to do away with their preliminary works almost entirely. Thanks to the development of their light railway system and its intensive exploitation, they were enabled to bring up their material without attracting the attention of the enemy.

At Riga, General von Hutier chose the point for the crossing of the Dvina, that is to say the point for the break-through of the hostile front, in the neighbourhood of Uxhull (a few kilometres south-east of Riga) for the precise reason that a wooded zone extended to the south of the river, which permitted all the preparatory works to be concealed.

3. *Conceal preparatory work from the enemy by: Strict control of traffic: Carrying out movements of troops only at night: Judicious employment of camouflage.*

The German Command, like the British Command, insisted upon the strict adherence to all these orders.

Closing of all routes in view of the enemy.

Movements to be carried out only at night when less than 40 km. from the lines.

Great improvements attained in camouflage, thanks to the repeated advice of officers visiting army corps.

Camouflage arranged a long time beforehand for batteries and munition dumps.

Great care to conceal the parks and bivouacs from direct observation by the enemy or his Air Force.

Lighting of large fires to be prohibited.

Prohibition of any digging for the artillery.

Concealment of guns in woods and ruins.

Digging in of telephone cable to be forbidden.

4. *To avoid as far as possible revealing the extent of air resources.*

Precautions enforced by the British and Germans, for instance, in the relief of balloons, was the successive ascent of another.

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5. *The Assembly for attack of Infantry Divisions of the first line should not be carried out till the last minute.*

The Germans attach great importance to the maintaining of higher formations as long as possible far from the scene of their offensive, and to pushing them forward at the last moment by the most rapid means.

It was thus that at Riga, they had concentrated their massed attack (8 infantry divisions, 2½ cavalry divisions), at 120 km. to the rear, in a zone whose conformation presented a great analogy with that where the operation was to be carried out, and where they had trained the infantry divisions for 10 days in open warfare and in every detail of manœuvre.

The attacking infantry division did not mass upon the front till the very night preceding the attack.

6. *To reduce artillery preparation as far as possible.* We will speak of this again later on.

7. *Finally, one last primary point in the effort to obtain surprise, is the rapidity in which two consecutive attacks follow on each other.*

It is essential the Germans say in their new Artillery Instructions, to insist that big attacks are carried out in a single day.

The year 1918.

Surprise added to the power of material was thus the principal characteristic of the great offensives of 1918. The two adversaries sought it and obtained it under different forms.

German side. You have all of you still alive in your memory the overwhelming successes of the Germans in the spring of 1918, and which they attained, by applying with even more formidable resources, the methods which had stood them in such good stead at Riga. On the 21st March, from the north of Arras as far as the forest of St. Gobain, their attack upon this front of 80 km. was launched after a preparation of barely a few hours, by 40 infantry divisions in the first line, against 14 British divisions. The two first days they advanced 15 km., 10 km. in the two following, 40 km. from the 26th to the 31st March, the day upon which they attained Montdidier. *The 27th May,* under similar conditions, a mass of 40 infantry divisions, of which 16 were in the first line, was suddenly launched upon a front of 35 km., held by 5 Franco-British infantry divisions. On the 30th it was at Chateau-Thierry. In these attacks one always finds the same general characteristics.

To effort to obtain surprise by the means already quoted.

Violence and briefness of preparation.

Formidable power of the attacking force, and of a force detailed for the intensive exploitation of the initial success.

On the French side. "But the events of the morrow should prove that the French command itself already knew," as General von Ardenne wrote, "how to use astonishing stratagems for the concealment of its preparations".

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Our strategy has sought to obtain the result, less by the weight of the blow struck, than by the *disorganisation produced in the general dispositions* of the enemy.

It is above all by the considered choice of its points of attack, by the variety and by the suddenness with which its offensives were launched, that the Allied Supreme Command obtained immense results with relatively restricted means.

We have obtained surprise by doing away with artillery preparation almost completely, thanks to the *neutralising effect by gas and smoke shells*, and above all by the *employment of massed tanks*, which at the same time enable us to solve the delicate problem of the *close artillery support of infantry*. At the same time, to provide against the new conditions towards which the forms of battle are bound to evolve, our Supreme Command gave instructions to break away from the methods of static warfare and endeavoured to train all the new factors in methods of open warfare. That is to say in simple, bold and rapid methods of attack. This was the subject of an Instruction at the beginning of July, 1918, of which the following is a summary of the principles.

(1). *Attacks prepared with the utmost degree of secrecy* and launched with the maximum surprise designed for a break through by *tanks* with as little Artillery preparation as possible should tend above all to the seizing of ground occupied by the mass of hostile artillery, and beyond this a development in depth with a view to the immediate capture of distant objectives. In other words, the exploitation of success shall henceforward be immediate and deep, in such a way "as to ensure the continuity of effort and prevent the enemy from reorganising."

(2). *Infantry* capable nowadays of reducing local resistance by its own weapon will advance boldly, "*not hesitating to quit definitely the zone of action of friendly artillery*". It will be disposed *flexibly in depth* in such a manner as to admit of the *surrounding and outflanking of nests of resistance.*

(3). *Artillery* will carry out preparation as brief and violent as possible, above all keeping in view the following points:

Neutralising by gas and smoke shells the hostile Artillery and the principle defensive organisations.

Instead of consisting of uniform and parallel barrages, its supporting fire will be planned upon the movements of the infantry, making *particularly dense and deep concentrations* upon points where the infantry will have to make its effort.

It will give support as constant as as possible to the latter, *carrying out changes of position during the attack.*

Batteries or sections of accompanying artillery are placed if necessary at the immediate disposition of battalions or regiments.

(4). Finally, it will be possible to give to these units frontages of attack far greater than that for the attack of fortified positions.

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Such was the conception of battle during the last months of the war.

The excellence of the tactics of the master hand of the Supreme Command was, as we know, quickly vindicated, and it attained with the first effort the most important strategic results,

Certainly what will redound to the honour of our supreme command is to have grasped the decisive and opportune moment, to apply to the classic tactics of the battle of open warfare, all those destructive forces and that formidable material, the products of the war itself, which for four years appeared to have completely changed all the old principles of the art of war.

Effort to obtain surprise by the artillery.

It was thus only at the end of three years, that the offensive doctrine, developing an imposingly large scope, succeeded at last in 1918 in welding at one and the same time surprise and force, these two conditions essential to success, apparently mutually contradictory.

Of all the causes which have retarded this development, the bringing into action of artillery was no doubt one of the principal.

The size of the masses to be moved from one front to another, the mountains of projectiles necessary for its consumption, the complicated arrangement called for by the preparation of its shoots, even the duration of its destructive bombardments, the difficulties of moving it over torn-up ground, were mostly the causes which, for a long time, aggravated or gave rise to the delays in the preparation of these attacks.

And whatever precautions were taken to organize a considerable primary advance, proportional to the scope of the operation, by preliminary organization of the area of attack, on favourable portoins of the front, into "zones", it was very evident that they would remain illusory, so long as one did not strive to reduce to a minimum the time employed for the deployment of means of attack and their immediate getting into action.

Now for a long time, we must admit, we were far more concerned to augment the power of artillery by a continual increase of the number of guns employed, than by making for rapidity in bringing it into action.

And it was only in 1917, that the attention of the command was strongly directed to the improvement of the conditions of this intervention, and that real progress was effected with regard to this point.

Let us briefly examine the principal points bearing on it:

1. Bringing artillery into position.
2. Duration of preparation.
3. Changes of position of artillery after the first attack.

1. *Bringing large forces of artillery into position.*

The effort to obtain rapidity in deployment, entails above all for artillery, the fulfilment of the following conditions.

(1). The avoiding for as long as possible the concentration of resources behind the front of attack.

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(2). The moving only at the last possible moment of these resources to their fighting position, and the putting into line *en bloc* all the supplementary artillery, that is to say in a few nights.

(3). The working out of all these movements, in such a manner that preparatory fire follows as quickly as possible after the deployment of artillery.

But on the other hand, artillery must be ready to fire, that is to say :

1. The emplacements must be completed.
2. Ammunition must be on the spot.

There are thus contradictory conditions : and in fact the rapidity of deployment of artillery for reinforcements consists of :

A. Works to be constructed.

B. The daily consumption of artillery on the front.

C. The establishment of an ammunition supply system.

A. *Works to be constructed.* From the moment surprise effect was aimed at, it was obviously necessary to renounce bringing batteries up to position beforehand, in order that they could construct their emplacements themselves.

The initial enemy reaction being in general rather weak, the necessity for bomb-proof dug-outs was no longer felt, and it was then admitted that it was sufficient for the batteries to have at most 48 hours before the opening of fire to carry out the most simple works, on condition :

(1). That there had beforehand been established in the proximity of the battery zone, some carefully camouflaged dumps of useful material.

(2). That the troops in sector had carried out beforehand all the work which concerns the general organisation of fire : the choice of reference points, the principal observation posts, maps, advanced telephone exchanges, etc.

B. *The capacity for artillery in the area.* This degree of daily receptivity of the front has been very variable; it naturally depends, upon the state of the ground, the capacity of the road system of the advanced area, and the organisation of traffic.

In the spring of 1915, in Artois, about three weeks were required to put into line the 350 guns of the reserve heavy artillery of the Xth Army.

In the IInd Army in August 1917, at Verdun, the deployment of the 160 reserve brigades was rather slow; it lasted 42 days (on an average a half brigade daily into a sector of an infantry division). The attack took place 12 days later.

In the VIth Army in October 1917 (La Malmaison), it was quicker and attained at least one group and a half per day and per infantry divisional sector. It was completed 17 days before the attack.

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It appears, after the experience of certain reinforcing moves, that one could attain better results and put into line by night at least 3 brigades per sector of an attacking division. At Cambrai, with one single road per army corps, the British reached 15 batteries per army corps sector.

C. *Establishment of the ammunition supply.* It is very obvious that the time necessary for the establishment of this supply must have its influence on that of the minimum duration of the deployment of a mass of artillery, since for the transport of munitions from army depôts to the batteries, one is obliged to take into account the personnel and transport resources of this supplementary artillery.

For a long time, it was admitted, from the lessons of attack of the nature of Verdun (20th August), or *La Malmaison*, that to allow for the establishment of munition supplies, it was necessary at a minimum, to eschelon the deployment over *about 7 nights from J—15 to J—8*[1], which gave four days' respite to the late arrived batteries, and left a margin of 4 days for artillery preparation properly so-called.

But little by little, the increase of our motor transport capacities (daily capacity 15,000 to 18,000 tons), has allowed improvement in practice on these theoretical statistics, the abolition of the large battery dumps, and to assure to the massed attacking artillery the daily supply on the spot of necessary munitions.

On the other hand the progressive decrease of the duration of the preparation has as an immediate result a similar decrease in the total weight of munitions to be consumed.

To sum up, thanks to the progress realised in these three factors, we have been able finally in our last offensive actions, to reduce to three or four days at the most the duration of artillery deployment, which is, all the same, an extensive affair, and thus we have contributed to a great degree to obtaining surprise effect. *It was for example that in April 1917* the attack of the 4th Army before Moronvillers, the 187 reserve batteries of heavy artillery, that is to say 500 guns, did not begin to arrive in the army zone until the 25th March. Nevertheless they were ready to fire on the 1st April.

For the attack on the 18th July, 1918, before the forest of *Villers-Cotterets*, all the artillery was brought up in three nights, and the attack commenced the following day. One sees progress effected in this direction. It is due partly to the employment of motor transport, as well as to the improvements brought about in the orders for traffic control, which admits of the more and more rapid carrying out of the movements of masses of artillery from one sector to another.

The year 1918 gave a special demonstration with regard to this, by reason of the fluctuations to which it was subjected upon different fronts, not only on the 21st March, on the 27th May and the 18th July, but again in all the repeated offensive operations which followed. *But it is* thanks *to the excellent handling of artillery in mass*, that we were able, in fact, to attack upon immense fronts, with forces some-

[1] *J* being the day of attack.

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times inferior to those of the Germans, almost always effecting surprise, and building up in strength, for each of these powerful attacks, a mass of artillery capable of breaking the obstacle at the desired point.

11. *The duration of preparation.*

At the attack of the 10th Army, in Artois, the 9th May, 1915, the artillery preparation lasted nearly 7 days.

The 18th July, 1918, the same army debouched from the forest of *Villers-Cotterets,* without artillery preparation, and penetrated at the first effort 6 km. into the enemy lines. These two figures show in an eloquent manner all the advance made in three years from the point of view of our ideas upon this question.

The density of artillery. Theoretically, as much for the increase of surprise effect as for the decrease in expenditure of munitions, as well as the nerve strain and fatigue to troops and commanders, it is advisable to reduce as much as possible the duration of preparation. To this end, the first idea which presents itself is to augment the density of artillery. And in fact, as is shown in the table below, the density at the battle of Malmaison, was double that at the battle of the Somme.

Operations.	1 Field Gun per M.	1 heavy Gun per M.	Total less trench artillery, 1 Gun per M.
Somme (July, 1916)	36	30	17
Verdun (Germans, Feb. 1916)			20
Verdun (Germans, May 1916)			15
Aisne (April, 1917)	35	26	14
Moronvillers (April, 1917)	35	26	15
Verdun (October 1916)	28	17	10
Verdun (October 1917)	19	17	9
Malmaison (August 1917)	16	15	7
Cambrai (end of 1917)	(with tanks.)		12
Riga (end of 1917)	13	19	8
Germans, in March, 1918			8

We have done better still; in June 1917, the British, at the attack upon Messines, arrived at one gun per about six metres, and towards the same period upon, it is true, a very narrow front, in Flanders, the first army (General Anthoine), attained a density of one gun for 3 m. 50 (not counting trench artillery).

This celebated dictum is emphasized: "*Guns, ammunition, and more guns*". It would appear, however, that the maximum limit had been reached at Verdun, 1917, as at Malmaison, for despite ever-increasing demands of infantry in this respect, it must not be lost sight of, as Instructions of the higher command at this period have forcibly reminded us:

(1). *That all exaggeration of the density* of artillery has, as an inevitable reaction, the decrease in the width of the fronts upon which an attack can be carried out with the means at one's disposition at a given moment.

(2). *That, on the other hand, the effect* given is not always proportional to the number of batteries engaged, as in practice it is limited:

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By the necessity of observation.
By the room available.
By the difficulties of ammunition supply.

One has therefore been led to strike a balance between the two factors *resources and duration*, which effect the preparation. And it is thus that in the great attacks of 1916 and 1917, an effective mean of 5 days was arrived at. But admitting that towards the end of 1917, by resolutely fixing the mean at one day's consumption for all calibres, and by exceeding it even slightly for the short 155-mm., it was possible to carry out similar preparations in 4 days and even sometimes to reduce it to three, in cases where observation was easy. To finish with this question of artillery density, let us say at once that with a view to cutting short the ever-increasing demands made by the army or army corps commanders, the supreme command in May, 1918, issued a Memorandum annexed to the Instructions of the 30th October, establishing the allotments for 3 types of operation :[1]

The *maximum* issue, corresponding with the situation of an enemy "on his guard", that is to say reinforced and strongly dug in upon well-organised positions.

Medium issue, corresponding to the situation of an enemy more or less "surprised", and consequently not reinforced and moderately well-entrenched.

Minimum issue, corresponding to the situation where the enemy retiring either on being threatened, or before preliminary attacks, it would be necessary to change the attack formations into march formation.

These issues, which vary :

From 10 to 18 batteries per kilometre for field artillery, from 5 to 10 batteries per kilometre for heavy artillery, permit of rapidly estimating the artillery necessary for an offensive.

In reality from the 18th July, 1918, when a general Allied offensive was launched upon the Western Front, everyone attacked with what he had, that is to say often with resources in artillery inferior to those provided for by the minimum issue. But as we have said before, the attacks which succeeded very well at *Cambrai* and *Riga* by cutting adrift boldly from the beaten tracks, proved at the end of 1917 that one could go much further with this system of cutting down the duration of preparation, thanks to the employment of *tanks and gas shells*.

Neutralization by gas shells. As long as explosive shells were the only means for neutralisation, one was naturally forced to precede every offensive action by a large number of counter-battery shoots, which, by reason of ranging and of fire for effect, naturally necessitated a certain duration of preparation. Later on when we possessed powerful gas shells, it was naturally advantageous to substitute this preliminary counter-battery work for intensive neutralisation actions, as prescribed by the Instructions when seeking surprise effect. Counter-

[1] Based upon the experience of big attacks.

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battery work was thus given up during the preparation and carrying out of attacks, since it took too much time, and *neutralisation by the massed employment of gas shells*, became the normal method of counter-battery work, which led to an appreciable shortening of the duration of preparation.

Employment of tanks. In the summer, their use had been contemplated in the Instructions: "to attack by surprise upon normally quiet fronts and to destroy obstacles."

Whilst on the one hand, the position of these weapons is not needed to permit infantry to occupy defences completely disorganised by artillery, on the contrary, they acquire much extra value the moment they attack positions upon which, to increase surprise, only an abbreviated preparation has been carried out. Again, if there is a complete absence of preparation, this is even more the case. Thus, their employment is all the more necessary, and at the same time all the more easy, because the ground has not been torn up. But whereas the Germans, although constructing a certain numbers of tanks, had above all concentrated on the employment of gas shells, we adopted the tank without further ado, and obtained the double advantage of having on the one hand, a means of increasing surprise effect by the cutting out of preparation, and, on the other hand, the solution of the problem of close support of infantry by artillery.

Further, the principle cause of the success of our tanks, is that our Light Renault tanks were launched into the battle as they should be, at the psychological moment. We waited until we possessed great quantities before bringing them out, and well-commanded units were formed; other branches of the service had been trained to work with them. To sum up, the organisation bore fruit, and it will be to the honour of our supreme command to have been able, despite the impatience of many, to await the decisive moment. For new material has value only if it is employed *en masse* and if it enables the enemy to be struck under such conditions that a counter-blow is difficult for him. Now this was the case.

Progress effected in ranging and execution of fire.

Here again the progress realised permitted of the notable cutting down of the duration of the preparation. We can now cut almost completely the period of registration and ranging, thanks to the improvement in the technique of fire and its preparation.

Obtaining lines of fire and preliminary data by the map.

Meteorological corrections.

Grouping of charges by weight, etc.

Calibration of guns.

All these operations can be carried out beforehand; thus the batteries have no longer any need to arrive until the last moment, and to fire a few cautious rounds for corrections.

Further, the rapidity of fire of modern natures has permitted the considerable augmentation of the rapidity of fire for effect and their effect at a given moment.

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To sum up, thanks to these various improvements, the duration of preparation could be shortened, and, in 1918, the long artillery preparation of the preceding years definitely disappeared; a few examples will prove this:

German attack of the 21st March, 1918: Preparation of 5 hours (gas shells).

German attack of the 27th May, 1918: Preparation of 2 hours 40 minutes (gas shells).

French attack of the 18th July: Preparation nil (tanks).

British attack of the 8th August: Preparation nil (tanks).

French attack of the 8th August: Preparation of 45 minutes (tanks).

III. *Artillery movements following on the first attack.*

The forward bounds of the artillery, and especially of the heavy artillery, are certainly the most delicate phase of all break-through operations, the stumbling-block of all attacks.

The delays encountered in the putting into action of a new disposition of artillery are due to the following causes:

(1). There is the difficulty, in a degree hitherto unknown, of the movement of pieces and of the transport of munitions across torn-up ground, where sometimes not even the trace of a track or road exists. However other things being equal, the shorter the preparation, the less this difficulty will be felt. This should be borne in mind.

From 1916 upon the Somme, one knows what difficulties were encountered over this vast expanse of shell-holes, and the carrying out of the simplest movements of artillery involved such delays, that an exploitation of success became impossible.

The experience of 1917 only confirmed this truth, and even in 1918, despite the general character of open warfare at the end of the campaign, artillery encountered the utmost difficulties in following up.

(2). The sudden drop in the fighting efficiency of the artillery organisation after its change of position, is derived from the fact of its being brought face to face with unknown ground, and with an improvised observation system, difficulties to which must be added also the imperfections of new communications put up in a hurry. To a certain extent, it was possible to alleviate a few of these inconveniences by determining beforehand, at least approximately:—

The new observation posts and battle H.Q's.

The new organisations of the command and groupings.

The laying out of new signal lines.

The allotment of new zones of action.

And even by fixing *a priori* the greater part of the new battle positions and establishing beforehand the corresponding fighting maps.

However, the problem of moving artillery on the field of battle, has not met with a satisfactory solution.

If tractors, together with the employment of railways, have enabled us to solve the problem of moving artillery from one sector to

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another upon a vast front, that is to say the problem of the strategic mobility of artillery, the problem of its changes of position upon a field of battle, in other words tactical mobility, has not been solved during the war. It will only be done by the adoption of a system of artillery caterpillars, the system of the future.

CONCLUSION.

What will be the definite doctrine? Of what will the future battle consist? It would be hard to endeavour to prophesy the future.

Certainly, we shall always see again open warfare as in 1914, and as we have seen it at the end of 1918, since defeat alone, that is to say a *forced retreat* of one of the adversaries, will lead to the solution of the conflict. But certainly also one will seek to limit this retreat, and we shall again have resource to field fortifications.

Thus we cannot consider these operations otherwise than as a series of attacks or of defence of positions more or less fortified, preceded by periods of movement more or less long, over torn-up ground or in open country. There will then perhaps be no more reason to make such a profound distinction between static warfare and the war of movement in open country, since the operations to be contemplated proceed the one from the other, since even in open country one comes up against organised villages, or ridges and woods placed in a state of defence, and since we shall certainly fight, sometimes on positions, sometimes between positions, and perhaps even beyond the zone of these positions, over a ground which may be free of all defensive organisations.

We must not, therefore, think that the general and definitive form of the battle will be a struggle against stabilised fronts as we have known them during more than three years, with its slow and restricted methods of procedure.

This, in the highest sense of the word, will require more elasticity, more rapidity in conception and decision, and as Marshal Foch says :—

"The improvements in industry will modify the characteristics of war, will continue the evolution of the art, but without changing in any way the fundamental principles of the conduct of war."

"Mobility and manœuvre alone will always produce success."

Another important conclusion to be drawn from this evolution of the procedure of fighting in the course of the war, is that if armies at the beginning of the war be compared with that at the final stages, radical changes will be perceived.

Artillery and engineers have been more than doubled, whilst the cavalry and infantry have been reduced; in the latter, the personal weapon (the rifle) has had to give place to many specialities such as grenades, machine-guns, machine rifles (lt.m-guns), guns of small calibre and trench mortars.

Further, the motor transport, transportation services, aviation, tanks, have developed to an enormous extent. Anyway, material and mechanism in all forms have invaded all the branches of the service and

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all modern armies, and dominate to-day the conditions of war to such a point, that without them the most heroic valour would only end in a bloody disaster. But this mechanism and this material will still continue to develop and improve during peace; the armies of to-morrow will have then, for fear of finding themselves in the next war with obsolete weapons, to follow unceasingly the improvements, adapting their form and their organisation to the new materials which will arise, to teach the employment of these to their soldiers and to enlarge the industrial output for the day of war.

It is enough to say, how much more delicate and difficult the technical instruction of the troops will become in all branches of the service, and how with the time of training more and more reduced by the financial necessities imposed from henceforth upon nations, the task of the officer personnel will become more heavy, and will demand more work on their part, more intellectual work and a more scientific brain.

And yet, although to a certain extent, material bolstered up moral, we must not let ourselves run away with the idea that material, however perfect, is all that counts.

The moral of the combatant will always remain the supreme argument in war, and it is with material handled by men that war will always be made, and to conclude, the truth of which you must remain convinced is that the solid moral education of the soldier will always remain the fundamental element of success and of victory.

END.

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HORSE v. TRACTOR.

BY MAJ.-GENL. R. BANNATINE-ALLASON, C.B., C.M.G.,
COL. COMDT., R.A.

MAY I supplement General Headlam's experiences, in, perhaps a lighter vein, if that is permitted in this serious journal. I am not particularly concerned with the subject of Horse *v.* Tractor, and, in fact, have quite an open mind. I prefer, however, for the present to rely more on what 'God' has given us, than on what 'man' has dreamt.

General Headlam has given us an instance of tractors 'Sticking in the mud'. The following tale gives an example of tractors sticking on dry land!

In South Africa, about the middle of the war, it was desired to return some troops detached from Bloemfontein. The task was assigned to a steam tractor or two, I forget which. Heliographic communications reported the non-arrival of the convoy—and anxiety—was followed by a relief party. It should be explained that the ground was dry at that time of the year, though, of course there were springs to be negociated. Well, the tractors were found marooned about half-way, short of coal and water. It may be said of course that this was bad staff work. But it is hardly bad staff work that certain countries are roadless, coalless and waterless—possibly also, oilless!

The moral of this little tale is that tractors like men and horses require food. They also, like men and horses, suffer from internal disorders—tho' possibly they are spared abdominal pains.

Yet another little story which is interesting, for in war, as in peace, one comes across amusing incidents which may be, and sometimes are, quite instructive.

When training a division at Bedford towards the end of 1914, we had, for reasons which were, no doubt, adequate, but which were not apparent to the ordinary soldier, to organize rapid moving patrols to catch German motorists: To save, I suppose, horse flesh. Energetic staff officers and gunners practised the movement of guns and detachments of infantry with motor lorries, the gun being trailed behind the lorry.

This experiment on good roads was quite successful and, at any rate, was quite a useful variation in the monotonous 'daily toil.' However that may be it attracted the notice of a very excellent engineering firm and we were approached with a view to further use of tractors.

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The firm undertook, and thought they might be able, to move our guns accross country—any country. A trial was arranged and an unusually thoughtful staff officer selected ground which would fairly tax the tractors. The ground was a fair sample of good bad and indifferent with a liberal allowance of Bedfordshire mud. I attended the trial. The tractor used was a Wheetid Steam Engine, with the wheels assisted by adjustable battens. I do not know the horse power, but obviously a more powerful machine would do more work—and produce better results.

The gun—a 4·7″—was attached and off went the 'show' on the road. No difficulty whatever. I was expecting the tractor to turn in at a gate—but to my astonishment it suddenly wheeled to the left and took the not very imposing fence and ditch in its stride so to speak and proceeded on some fairly firm ground, so far so good. Then however it struck a bit of really Bedfordshire clay and tractor and gun became hopelessly bogged. No amount of puffing and blowing would move anything. But the tractor people disengaged themselves, proceeded to firmer ground, produced and made fast to the gun a steel hawser and, having scotched the engine proceeded solemnly, slowly but surely to wind up the gun to firmer ground. A triumph of engineering skill. But there is a moral also to this little tale indicated in the following reflection. Imagine the ecstasy of the F.O.O.—observing a line of 40 or 50 tractors solemnly slowly and surely winding their guns into position!

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—March, 1922.

I. Operations of the Belgian Army. (Continued).

II. On the siege of Namur (with 3 maps). Cap. Comdt. Herbiet

III. Security on the march. Col. Van Emelen.

V. The Infantry Gun, and the artillery of accompaniment.

I. In France a 37mm. gun, and 2 Stokes mortars form a section of the machine gun company of a battalion of infantry.
Description of weapons—number of men required for a change of position is 33—a cumbersome weapon—Gun carrying tank would seem more practical.

II. The artillery of accompaniment—criticisms of. French—Austrian—German.
Conclusions: Infantry should be provided with special artillery which lives with them to learn their line of thought, their wants and their methods of fighting.
Each regiment to comprise a battery of 105 Howitzers on a caterpillar mounting—The battery to consist of 4 guns and 8 ammunition carriers—The personnel to be infantrymen. (The American Army has experimented with a 7·5 gun or a 105 how.—a plate of the 75 is produced here). Cap. Comdt. Baron Guillaume.

VII. Belgian and French Aviation on the Western Front III. Cap. Comdt. Desmet.

VIII. Mobilization of the Nation for War (V). Cap. Comdt. Dendal.

IX. Review of recent Italian publications on ballistics II. L. Godeaux.

Switzerland.

Revue Militaire Suisse.—Feb. and March, 1922.

Preparation for War, and employment in war of the Battery and the Group. Capt. Kuntz.

France.

Revue Militaire Francaise.—Feb. and March, 1922.

Gén. Buat. Hindenburg and Ludendorff's campaigns on the Eastern Front. II. and III.

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L.F. The battle of Warsaw. I. and II.

Lt.-Col. Mussel. Study of a "System" of artillery. I. and II.

Col. Chedeville. The High Command and the employment of Tanks.

March, 1922.

Maj. Dumont. The military situation of to-day in Germany.

Revue Militaire Générale.—Feb. 1922.

I. The Trench of "Thirst" (Concl.) Gén. Cordonnier.

II. Strategy and operations. Capt. Kuntz.

III. The French Cavalry during the first 3 months of the war. Col. Monsenergue.

Notes on Foreign Armies. The Tchecko-Slovak mobilization (in the autumn of 1921, on the occasion of the attempt made by Charles of Habsbourg to seize the crown).

Revue d'Artillerie.—March, 1922.

I. Silent Registration by artillery. Gén. Challéat.

II. German Arillery in the "Break through" battles—The attack on the Chemin des Dames. Col. Muller.

III. Study of concentration of Artillery Fire. Capt. Desrousseaux.

IV. Laws affecting Trajectory and Time of Flight. Maj.P. de Saint-Maurice.

V. The Artillery Intelligence Service. Maj. Apffel.

VI. Guns on Railway Mountings—19 and 249. Maj. Maurin.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Der Grosse Krieg in Einzeldarftellungen. Volumes 1, 3, 11, 20, 21, 24, 26, 27, 28, 31, 33, 39.

Der Feldzug der 9 Armee gegen die Rumanen und Russen, 1916-17. By Genl. Falkenhayn. Berlin (Mittler) 1921.

Fünf Jahre Türkei. By Genl. Liman von Saunders. Berlin (Scherl) 1920.

Des Generalobersten Frhrn von Hausen. Erinnerungen an den Marnefeldzug, 1914. By F. M. Kircheifen. Leipzig (Koehler) 1920.

Mit Lettow-Vorbeck durch Afrika. By Ludwig Deppe. Berlin (Scherl) 1921.

Geschichte des Krieges. 4 Vols. By Hermann Stegemann Stuttgart (Deutsche Berlags-Unstalt) 1918-21.

(Above presented by Major-Genl. Hon. Sir F. R. Bingham, K.C.M.G., C.B.)

L'Artillerie dans l'Offensive. Reflexions et Souvenirs. By Col. J. Roger. Paris (Berger—Levrault) 1922.

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REGIMENTAL LIST. The following Postings have occurred during the period 16th January, 1922, to 15th February, 1922.

Postings.—R.H. and R.F.A.

Alves, Major (Bt. Lt.-Col.) H. M. J., D.S.O., from 34th Bde., to 49th Batty. 9/3/22.
Atchison, Lt.-Col. H. W., from 31st Bde., to 27th Bde. 28/2/22.
Barlow, Lieut. V. G., from R.E. Mounted Depôt, to Att. 8th Bde. 7/3/22.
Barrett, Lieut. E. J., M.M., from Att. Irish Comd. to 14th Bde. 18/2/22.
Benson, Major R., D.S.O., from 7th Bde., to 92nd Batty. 2/3/22.
Bishop, Capt. C. B. J., M.C., from 1 Depôt, to R.F.A., India. 14/3/22.
Blythe, Lieut. G. W. F., from Att. Irish Comd., to II. Res. Bde. 25/2/22.
Campbell, Lieut. A. P., from Staff, to 112th Batty. 2/12/21.
Carbery, Capt. D. H. M., M.C., D.F.C., from Depôt, India, to 107th Batty. 31/12/21.
Carkeet-James, 2nd Lt. C. R., from 40th Batty., to 133rd Batty. 7/12/21.
Cousens, Major (Bt. Lt.-Col.) R. B., D.S.O., from Staff, to 23rd Batty. 11/3/22.
Cullum, Maj. E. G. L., from IV. Res. Bde., to 128th Batty. 22/2/22.
Deacon, Capt. H. W., D.F.C., from 29th Batty. R.F.A., to Survey Coy., R.G.A. 6/3/22.
Edge, Capt. J. D., M.C., from 2nd Bde., to R.F.A., India. 2/3/22.
Fowle, Lieut. H. A., from 112th Batty., to 111th Batty. 1/12/22.
Gallagher, Lieut. L. S., from Staff, to 109th Batty. 7/12/21.
Gardiner, 2nd Lt. R., from 133rd Batty., to 40th Batty. 6/1/22.
Goble, Lieut. (Qr.-Mr.) W. R., from R.H.A. Depôt, to 5 Depôt, R.F.A. 7/3/22.
Hesketh, Lieut. (D.O.) A. J., from Depôt, India, to 3rd D.A.C. 24/11/21.
Hickey, Capt. J., M.C., from Staff, to 23rd Batty. 28/2/22.
Honner, Capt. P. J. C., M.C., from 16th Batty., to 138th Batty. 23/2/22.
Imbert-Terry, Major H. B., D.S.O., M.C., from Staff, to Unposted. 5/3/22.
Jenner, Lieut. S. B., from Staff, to 13th Bde. 18/2/22.
Jervis, Lt.-Col. N. G. M., D.S.O., from 14th Bde., to R.A. Depôt, India. 28/2/22.
Joyce, Lieut. W. T. C., from Att. R.E., to II. Res. Bde. 25/2/22.
Lassetter, Lieut. W. P., from 102nd Batty., to 113th Batty. 3/1/22.
Lewer, Lt.-Col. L. W., D.S.O., from 145th Batty., to 27th Bde. 13/3/22.
McNeil, Lieut. D. R., from Unposted, to Att. 34th Bde. 8/3/22.
Martin, Lieut. F. W., from Att. Irish Comd., to 10th Bde. 18/2/22.
Martin, Capt. G. N. C., D.S.O., M.C., from 107th Batty., to Adjt., 23rd Bde. 1/12/21.
Mitchell, Lieut. A. J., from Att. Irish Comd., to 66th Batty. 18/2/22.
Napier, Major (Bt. Lt.-Col.) V. M. C., C.M.G., D.S.O., from 7th Bde., to 144th Batty. 11/3/22.
Nightingale, Capt. (Qr.-Mr.) T. G. H., M.B.E., from 5 Depôt R.F.A., to R.H.A. Depôt. 7/3/22.
Nornabell, Major H. M., D.S.O., O.B.E., from 37th Bde., to 4th Batty. 21/2/22.
O'Farrell, Lieut. R. C., M.C., from I.O.D., to 100th Batty. 1/2/22.
Paterson, 2nd Lt. J. F., from 137th Batty., to 82nd Batty. 3/3/22.
Patterson, Lieut. L., M.C., from Staff, to II. Res. Bde. 2/3/22.
Renny-Tailyour, Major J. W., D.S.O., from 138th Batty., to "G" Batty., R.H.A., 24/2/22.
Rowbotham, Lieut. G. R., from Staff, to Att. 35th Bde. 14/3/22.
Somerset, Capt. R. G., M.C., from Staff, to Unposted. 9/10/21.
Sparey, Lieut. J. S., from Att. Irish Comd., to 15th Bde. 18/2/22.
Stamp, Lieut. A. F., O.B.E., from Att. Irish Comd., to 33rd Bde. 18/2/22.
Stirling, Major W. A., D.S.O., M.C., from Staff, to 61st Batty. 7/3/22.
Wark, Lieut. (D.O.) H., from 3rd D.A.C., to 2nd D.A.C. 24/11/21.
Wark, Major (Rid.-Mr.) R. G., from Att. R.G.A., to 20th Bde. 23/12/21.
Wheeler, Lieut. F. C. B., from Experimental Establishment, to Att. 1st Bde., R.G.A. 14/3/22.

Postings.—R.G.A.

Alexander, Lt.-Col. R. C. J., from 27th Batty., to N. Scottish Coast Def. 7/3/22.
Bartholomew, Lieut. P. A., from Experimental Establishment, to Att. 1st Bde. 14/3/22.
Bedbrook, Lieut. H., M.M., from "D" Coast Batty., to Portsmouth. 22/2/22.
Boyle, Lieut. C. L., from "E" Coast Batty., to 66th Coy. 22/2/22.
Brettell, Lieut. W. J. H., M.M., from Sierra Leone Coy., to Unposted. 14/3/22.

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Postings R.G.A.—(Continued).

Browne, Major B. S., from Att. Irish Comd., to "J" Coast Batty. 18/2/22.
Carew, Capt. R. L. O., from Plymouth, to 2nd P.A. Bde. 14/3/22.
Clarke, Lieut. H. O., from Att. Irish Comd., to "L" Coast Batty. 28/2/22.
Collins, Lieut. T. V., from S. Irish Coast Def., to Dover. 22/2/22.
Desbrow, Capt. P. D., M.C., from Att. Irish Comd., to Portsmouth. 18/2/22.
Dunsterville, Major K. F., D.S.O., from 38th Ad. Class, to Unposted. 8/3/22.
Elliott, Lieut. A., from 50th Coy., to 1st A.A. Bde., R.F.A. 11/3/22.
Emptage, Lieut. E. E., from Att. Irish Comd., to "P" Coast Batty. 8/3/22.
Goodger, Lieut. H. W., from Experimental Establishment, to Att. 1st Bde. 14/3/22.
Haines, Lieut. J. L. P., from Att. Irish Comd., to Personnel, Arty. Coll. 28/2/22.
Harler, Lieut. F. C., from Staff, to "H" Coast Batty. 8/3/22.
Harwood, Lieut. A. F., from Att. R.C. Signals, to Aden. 24/2/22.
Hebbert, Capt. G. K. P., M.C., from Staff, to S. Irish Coast Defences. 8/3/22.
Honey, Capt. W., M.C., from Att. Irish Comd., to Tees & Tyne. 18/2/22.
Horner, Capt. C. E., M.C., from Sierra Leone Coy., to Unposted. 14/3/22.
Kemble, Lt.-Col. W. E., from Staff, to Portsmouth. 1/3/22.
Le Gassick, Lieut. F. N., M.C., from S. Irish Coast Def., to "M" Coast Batty. 24/2/22.
Manners-Smith, Lieut. L. C., from 41st P. Batty., to Frontier Garr. Arty. 10/3/22.
Martin, Lieut. R., M.C., from Experimental Establishment, to Att. 1st Bde., R.G.A. 14/3/22.
Matthews, Major E. D., from 7th Batty., to Command, H.K. & S. Btn. 8/3/22.
Merrett, Capt. A. B., from Staff, to S. Irish Coast Def. 2/3/22.
Nicholson, Major W. S., from Adjt., 22nd P.A. Bde., to 8th P.A. Batty. 23/2/22.
O'Leary, Lieut. B. J., from Staff, to I. Res. Bde. 18/2/22.
Peiniger, Major R. F., from Staff, to I. Res. Bde. 25/2/22.
Phillips, Lieut. F. V., from Att. Irish Comd., to "I" Coast Bty. 28/2/22.
Porter, Capt. G. T., from 50th Coy., to Unposted. 14/3/22.
Rowett, Capt. R. B., M.C., from S. Irish Coast Def., to N. Irish Coast Def. 22/2/22.
Shadbolt, Capt. C., from Thamas &Medway, to Dover. 9/3/22.
Shiel, Lieut. G. L., M.C., from Sierra Leone Coy., to Unpostd. 14/3/22.
Teesdale, Capt. P. H., M.C., from 41st P.A. Batty., to Adjt., 22nd P.A. Bde. 23/2/22.
Tennant, 2nd Lt. T. L. B., from 1st Batty., to 11th Batty. 9/3/22.
Thompson, Major W. R., from 50th Coy., to Unposted. 14/3/22.
Titmas, Lieut. T. W. L., from 1st Bde., to 6th Bty. 24/2/22.
Todd, Lieut. A. C., from 105th P.A. Batty., to 18th P.A. Batty. 9/3/22.
Traill, Major H. E. O'B., D.S.O., from Sierra Leone Coy., to Unposted. 14/3/22.
Willson, Capt. E., D.S.O., from 50th Coy., to Dover. 28/2/22.

Staff Appointments.

Royal Horse and Royal Field Artillery.

Adam, Major R. F., D.S.O., O.B.E., G.S.O. 3, S.D. 8.
Bayley, Lieut. C. D., M.C., Adjt., 101st (Glasgow Yeo.) Bde., T.A. 15/3/22.
Bontor, Lieut. A. A., M.C., Seconded to R.A.S.C. 1/1/22.
Brown, Lieut. A. E. L., Seconded to Royal Corps of Signals. 1/1/22.
Denvir, Lieut. E. G. J., M.C., Cipher Officer, Iraq. 3/1/22.
Durie, Major T. E., D.S.O., M.C., Major I.G. (Survey) Arty. School, Larkhill. 12/1/22.
Gage, Lieut. E. H., M.C., A.-D.-C. to G.O.C.-in-C., Eastern Command. 1/3/22.
Hammick, Bt. Lt.-Col. R. T., D.S.O., G.S.O. 2 (Intel.) Egypt. 6/3/22.
Holland, Lieut. V. C., Att. Royal Corps of Signals. 12/3/22.
Howard, Lieut. C. E., Colonial Employ (Palestine Gendarmerie). 1/10/21.
Kaye, Capt. G. L., M.C., Capt. I.G. Arty. School, Larkhill. 8/2/22.
Lambert, Major A. F., M.C., Bde. Maj. R.A., 4th Divn. 15/2/22.
Mackenzie, Lieut. J. P., seconded to Royal Corps of Signals. 1/1/22.
O'Donnell, Lieut. E H. A. J., Staff Capt., A.G. 1. (b). 1/4/22.
Orr-Ewing, Capt. M. R., M.C., Seconded as Adjt., T.A. 19/1/22.
Reynolds, Capt. B. T., M.C., Interpreter, Rhine Army. 29/5/21.
Rowe-Evans, Lieut. C. B., Garrison Adjt., Constantinople. 1/2/22.
Willis, Maj.-Genl. E. H., C.B., C.M.G., Maj.-Genl. R.A., G.S. Branch, India. 3/11/21.
Thomson, Major J. N., D.S.O., M.C., G.S.O. 3. M.O. 1. War Office. 25/2/22.

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Royal Garrison Artillery.

Atwill, Lieut. A. L., Intell. Offr., 16th Inf. Bde. 1/3/22.
Barron, Bt. Lt.-Col. F. W., O.B.E., G.S.O., 2nd Grade M.O. 2. 3/2/22.
Bateson, Bt. Lt.-Col. J. H., C.M.G., D.S.O., Staff Officer R.A., Southern Command, India. 16/2/22.
Becher, Capt. L. B. A., Asst. Inspector, Inspection Staff.
Bennett, Capt. F. V., Capt. I.G., Singapore. 24/2/22.
Buckland, Major G. N., D.S.O., G.S.O. 3., S.D. 3., War Office. 15/2/22.
Cox, Capt. H. A., Att. Officer, Q.M.G. 8. 6/2/22.
Healing, Major N. C., D.S.O., M.C., G.S.O. 3., M.I. 2. (b). 5/3/22.
Icely, Capt. B. C., Asst. Inspector, Inspection Staff. 1/4/22.
Maitland-Addison, Bt. Lt.-Col. J. F. R. N., C.I. Range Finding, Artillery College. 1/3/22.
Mears, Lieut. G. G., M.C., A.-D.-C. to Viceroy of India. 26/11/21.
Pellew, Major V. H. L., seconded for duty as Adjt., T.A. 17/1/22.
Rawson, Major C. D., D.S.O., G.S.O. 3., M.O. 4., War Office. 27/2/22.
Rennie, Lieut. T. S., Intell. Officer, Rhine Army. 16/2/22.
Spencer, Major F. E., D.S.O., M.C., Comdt. Singapore Volunteers, with local rank of Lt.-Col. 30/11/21.
Sayers, Major R. C., O.B.E., Staff Capt. A.1., War Office. 1/4/22.

Promotions (Regimental).

Alexander, Major R. C. J., to be Lt.-Col., R.G.A. 1/3/22.
Jervis, Major N. G. M., D.S.O., to be Lt.-Col., R.F.A. 24/2/22.
Lewer, Major L. W., D.S.O., to be Lt-Col. R.F.A. 7/3/22.
Peter, 2nd Lt. G. A. C., M.C., to be Lieut. R.F.A.. 13/7/21, with seniority 23/11/20.
Wynter, 2nd Lt. D. E. H., to be Lieut. R.F.A., 13/7/21, with seniority 11/3/20.

Promotions (Non-regimental).

Dobson, Lieut. S. F. A., to be local Capt. while holding present employ. 17/2/22.
Keogh, Bt. Col. J. H., D.S.O., to be Col. 14/3/22 with seniority 1/8/1920.
Lewin, Bt. Lt.-Col. E. O., C.B., C.M.G., D.S.O., to be Col. 14/3/22, with seniority, 1/1/1921.
Riddell, Lt.-Col. E. V. D., to be Col. 14/3/22, with seniority, 3/6/1920.

To Half Pay List.

Bareham, Lieut. F., R.F.A. 2/3/22.
Barton, Lt.-Col. R. L., R.G.A. 13/2/22.
Hanna, Col. J. C., D.S.O., on relinquishing Appt. 23/1/22.
Hope, Lt.-Col. J. W., D.S.O., on relinquishing Appt. 15/2/22.
Keogh, Bt. Col. J. H., D.S.O., R.G.A. 1/3/22.
Lloyd, Lt.-Col. O. S., R.F.A., temp. half-pay on account of ill health. 24/2/22.
Ogg, Lt.-Col. W. M., C.M.G., D.S.O., R.G.A., and to retain present employment. 4/3/22.
Riddell, Lt.-Col. E. V. D., R.G.A. 1/3/22.
Suther, Lt.-Col. P., C.M.G., D.S.O., R.G.A., and to retain present employment. 1/3/22.
Thorneycroft, Maj. G. E. M., D.S.O., temp. half-pay, on account of ill health. 21/2/22.

Commissions Antedated.

Tremlett, Lieut. E. A. E., Commission as 2nd Lt. R.F.A., antedated to 16/9/1915.

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Transfers.

Sansom, Major H. A., R.G.A., Removed from Regiment on permanent transfer to R.A.O.C. 22/2/22.

Retirements on Retired Pay.

Anderson, Major E. O., with rank of Lt.-Col. 17/2/22.
Cartwright, Col. G. N., C.M.G., D.S.O., with hon. rank of Brig.-Genl. 30/1/22.
Cuninghame, Lt.-Col. E. W. M., D.S.O., R.F.A. 7/3/22.
Devitt, Major K. H., from half-pay on account of ill health contracted on Active Service. 28/2/22.
Gorton, Col. R. St. G., C.B., C.M.G., R.G.A., with hon. rank of Brig.-Genl. 1/3/22.
Gray, Lt.-Col. C. L. R., D.S.O., from half-pay list. 16/2/22.
Harford, Major H. H. 17/2/22.
Hartland-Mahon, Lt.-Col. M. C. J., D.S.O., R.F.A., from half-pay list. 1/3/22.
Hogg, Lieut. G., from half-pay list. 28/3/21.
Lawrence, Capt. F. H., M.B.E. 22/2/22.
Lyddon, Lieut. J. 23/2/22.
Miles, Lieut. G. H., from half-pay list. 17/10/20.
Nelson, Lieut. R. D., from half-pay list, on account of ill health, with rank of Capt. 7/9/21.
Prewer, Major (D.O.) W. H. R., O.B.E. 19/2/22.
Renshaw, Major R. A. 28/2/22.
Wahl, Major C. E. J., from half-pay, on account of ill health. 28/2/22.
Wilkinson, Col. A. C., C.M.G., D.S.O., from half-pay list. 23/2/22.
Young, Major H. G., D.S.O. 23/2/22.

Retirements with a Gratuity.

Golding, Lieut. T. B. 18/2/22.
Grant, Lieut. J. L. 17/2/22.
Price, Lieut. A. E. 23/2/22.
Fowler, Lieut. A. S., M.C., R.F.A., from half-pay list. 14/3/22.
Harford, Major H. H., R.F.A. 17/2/22.
McLellan, Lieut. W., R.F.A., from half-pay list. 15/3/22.

Resignations.

Gosling, Lieut. A. G. S. 16/2/22.
Watkins, Capt. W. L., R.G.A. 6/3/22.
Wroth, Lieut. C., R.G.A. 14/3/22.

Cancellations.

Atwill, Lieut. A. L., R.G.A., posting to 66th Coy., from 5th Brigade, R.G.A., is cancelled. 22/2/22.
The Posting of Lieut. (D.O.) J. Old from Portsmouth to Gibraltar has been cancelled.

Deaths.

White-Thomson, Col. Sir H. D., K.B.E., C.B., C.M.G., D.S.O. 24/2/22.
Hunt, Lieut. W. W. F. (T.H.P.), at Winchester. 24/11/21.
Plant, Col. W. A. (retired pay), at Cheltenham. 10/2/22.

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"THE NORTHERN BLOCKADE."

A Lecture delivered at the Royal Artillery Institution, Tuesday, 7th February, 1922.

BY ADMIRAL SIR DUDLEY R. S. de CHAIR, K.C.B., M.V.O.

Colonel R. A. Craig, C.M.G., C.B.E., in the Chair.

THE CHAIRMAN: Ladies and Gentlemen, I have much pleasure in introducing you to Sir Dudley de Chair. We are very lucky indeed in securing him to lecture to us on the Northern Blockade. He commanded the 10th Cruiser Squadron and organised the Blockade. Later he commanded the Third Battle Squadron and was later attached to the Foreign Office as Naval Adviser, so that what he cannot tell us about the Blockade is either too secret to be told or is not worth knowing. (Applause).

SIR DUDLEY DE CHAIR: Mr. Chairman, Ladies and Gentlemen, the Lecture to-day is on the Northern Blockade and I have a chart here which was sent from Greenwich and on which I will be able to point out the position taken up by the blockading Squadrons, but it should be borne in mind that the blockade of Germany was world-wide, and was not alone confined to the North Sea or the English Channel, and also there were a great many departments of the British Empire which were concerned in making the blockade effective.

When the War started in 1914 although the Navy was well prepared in many ways for war yet the Blockade itself had not been properly thought out. There were many things about it, for instance the Declaration of London which was in force and was a great help to our enemies at that time. However, ships of the Northern Patrol were to take up their position in the North Sea between the Shetland Islands and Norway to shut off at first the exit to the Atlantic and to cover also the Fair Island Channel and the Pentland Firth.

The Orders which the Northern Patrol were given were to attack and sink all enemy war vessels and enemy ships which were armed, to capture all German merchant vessels, to intercept all neutral vessels and examine their cargoes, and also to deny a landing on the Shetlands to the enemy. A couple of days after the Declaration of War rumours got about that four German transports had left the Skager Rack with troops on board to land on the Shetlands, but they never appeared there, and also that German raiders had been fitted out by the enemy in order to get into the Atlantic and attack our commerce. On August 4th, the German armed Merchant Cruiser "Kaiser Wilhelm der Grosse" left the Elbe and steaming North keeping close in shore along the

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Norwegian Coast, got out into the Atlantic, passing round the North of Iceland. That was before the Northern Patrol had arrived on its station, otherwise I think we would have had her.

It will be noticed that on the Coast of Norway, there are a continuation of small Islands close in shore all the way up, and ships coming out from the Skager Rack can go up in shore, and keep in territorial waters the whole way, till they reach this point in Lat. 62° N.

Now the Squadron which was told off for the Northern Patrol consisted of our oldest cruisers. They were manned by nucleus crews, and being training ships they were full of boys. They could not be prepared for War until the order to mobilise had gone out, and as the Mobilisation Order did not come out before August 2nd, these ships could not leave the South of England before they were properly manned, and the boys taken out of them.

On August 1st, 1914, at 2 p.m. I happened to be at the Admiralty and was told off to take that Squadron to sea and carry out the blockade in the North. I hastened to Portsmouth and found there three of the 10th Cruiser Squadron, the "Crescent", the "Grafton", and the "Edgar"; three other ships were at Plymouth, one at Sheerness, and one at Queenstown. On August 2nd, Sunday, the order to mobilise was received, the boys had been sent on shore, the reservists came on board, and by extraordinary efforts on the next day August 3rd, I was able to leave Portsmouth with the three ships, having wired to Plymouth for three other ships to meet me off the Eddystone. Steaming down Channel I was disappointed in this, as those ships were not ready, so hastening on I passed the Land's End with only three ships, and proceeding up the Irish Sea received a wireless telegram from the Admiralty about 2 o'clock on the morning of August 5th to the effect that War was declared with Germany. At daylight we captured a German ship off the west coast of Scotland, and sent her into the Clyde—with a prize crew (she had valuable cargo) and then proceeded through the Minch to Scapa Flow, which was to be the Port of the Tenth Cruiser Squadron. The delayed ships followed as soon as they could, and curiously enough off the Isle of Man the "Gibraltar" captured another German ship, and sent her into Liverpool with a prize crew, while the other two ships joined later. On the arrival of the Squadron at Scapa Flow we proceeded to fill up with coal at once, and directly we were ready went out into the North Sea to our patrol.

About this time the Germans were very anxious to know what our blockade movements were, as they realised that we intended to blockade and they had heard a certain amount about our movements. In order to ascertain what we were doing they sent out ten submarines, on a line Eastward from Peterhead, in line abreast, as they thought apparently that this was to be our line of blockade. However, when they got there they found nothing, but one submarine happening to have a little more fuel than the others thought she might go further, and on coming back she sighted a cruiser with several destroyers,

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which gave the Germans the idea that our blockade ran from somewhere between Scapa and Stavanger, and it confused them a good deal.

After we had coaled we proceeded with all despatch to our patrol area, and the first bag we got was a brace of German sailing trawlers. They were more surprised than I can describe on being captured, and hearing that War had been declared at all. However, we took the crews out, and sank their boats, and after giving them a good square feed we made prisoners of them and sent them ashore. The Tenth Cruiser Squadron, then consisting of eight old "Edgar" class Cruisers, was working in two divisions, one near the Shetlands and the other off the Coast of Norway. There is a position in about 62° North where ships have to come out from territorial waters in order to get to sea at all; and that was the place where we were stationed at first to try and capture them.

In Germany, when War was declared, everything had been very well thought out and prepared. Many of her large liners had their guns in their holds, ready to mount on War being declared, but on July 31st telegrams throughout all the world to German ships, called them into Neutral Ports, so that very shortly after the Declaration of War there were hardly any German Mercantile Ships at sea.

The Grand Fleet in the meantime was working in these waters and making sweeps down to Heligoland, backwards and forwards, and keeping the North Sea well searched. From time to time the Commander-in-Chief called on the 10th Cruiser Squadron for some of the Cruisers to assist in these sweeps to Heligoland. At the time when the Canadian Contingents were coming over from Canada, it was considered necessary to keep a good look out that no ships of the German Fleet got out into the Atlantic, and the 10th Cruiser Squadron was brought down, and placed in what we called Area Six, off the East Coast of Scotland, so that any ships coming from Germany to the North would first have to pass through the 10th Cruiser Squadron, and this Squadron would be able to give timely notice. Of course we felt at that time we were unable to cope with German Battle Cruisers, but we could always do our best, and use our wireless, to inform the Commander-in-Chief when they were coming.

About this time in the "deep fourteens", three British Cruisers were torpedoed by a German submarine; the Commander's name was Otto Von Weddigen, and his submarine U.9. He torpedoed one of these ships in the morning early, and she sank very rapidly and turned over throwing a lot of men into the water. Another ship of that Squadron going to her assistance, was torpedoed by the same craft, and the third one was also torpedoed when going to their aid, which disaster called from the Admiralty the Order that ships were in future not to go to each other's assistance. It was rather hard at the time to obey, but still we found it very necessary and had to do it.

This German Officer in U.9. with other submarines then came North to the 10th Cruiser Squadron. We were spread out, and cruising on a line out of sight of each other, and we had to examine ships, and often had to send boats on board these ships to examine them. Con-

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sequently very often the ships of our Squadron had to slow down for about two or three minutes while we were sending a boat, and this was naturally a very good opportunity for the German submarines. On Oct. 15th about 1 p.m. the "Theseus", one of the ships of the Squadron, reported by wireless that a torpedo had passed three or four yards from her rudder, and the whole Squadron were then ordered to steam full speed to the Northward, zig-zagging, and that was the first indication that we had of the loss of the "Hawke", because there was no answer to the signals to her. After we had called her about a couple of hours, the Commander-in-Chief was informed that we could not get her to answer, and we feared something had happened to her. The Commander-in-Chief then directed the "Swift" out of Scapa, to proceed South, and a Flotilla of Destroyers, and the "Swift", in their search found several men on a raft. They belonged to the "Hawke" and told the Captain of the "Swift", that the "Hawke", had been torpedoed, that she had been hit amidships under the foremost funnel, that the ship had turned over, and sunk with a loss of from 500 to 550 men, and that the only people who were saved were this little party on the raft, and also a certain number who got away in a boat, and were picked up by a Dutchman later on.

This showed the Commander-in-Chief that the submarines were getting active, in our vicinity, so we were sent back to our cruising station in the North. The Admiralty then chartered three ships, the "Oceanic", the "Alsatian" and the "Mantua". They were large liners commanded by a Naval Captain, carrying a Naval Gunnery-Lieutenant, Naval Reserve Officers and Men, Naval Volunteer Reserve, and Mercantile Marine Ratings. They were very large ships, the "Alsatian" was about 19,000 tons; she carried 6,000 tons of coal and she could keep at sea for six weeks at 13 knots. Her full speed was about 20 knots; she seemed to be a very good sea boat, and consequently was very acceptable on the Blockade and on the Patrol Line where the weather was sometimes very rough. During this time the submarines from Kiel, and also from the Elbe, were very active and one of those sweeps which were made North by the submarines to find out where our Blockade Line was, came in contact with some of our Cruisers one day. The "Birmingham" rammed one and sank her at once, and another submarine was sunk by gun fire, but it was not until after the War was over that we knew definitely that she had been lost and the Germans could never account for her disappearance; that she never got back to Germany was all they knew.

Shortly after a ship called the "Prinz Frederick Wilhelm" got into Bergen; she was one of those on the list which had guns in her hold, ready for mounting as a commerce destroyer, and we were very anxious to catch her, but we could not go into the Harbour to get her, so we stationed one of our ships outside until eventually the Norwegian Government interned her.

The 10th Cruiser Squadron after the incident of the "Hawke", resumed their patrol up North, and shipping began then to get very

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much more numerous. Although no German ships seemed to be passing at all, yet, at the same time, there were a great many neutral ships which were passing from the United States of America, and from South America, and were coming "North about" and making the Coasts of Norway, Denmark, and Holland. They preferred to go that way rather than in through the English Channel, as they thought they had more chance of getting through perhaps, and, at the same time, the German submarines were also in the Channel on the look-out for our transports which were carrying the Expeditionary Force.

Scapa Flow became the Base for the Grand Fleet, but it was rather too far off our patrol for the 10th Cruiser Squadron, so we used the Shetlands entirely at first, a Harbour an the East Coast called Lerwick, and some of our Cruisers went round to the west and found out a very nice Harbour indeed, which we used later on, called Swarbacks Minn. It was a wonderful harbour this Swarbacks Minn and could contain a great number of ships; it was very deep, just like a Norwegian Fjord and very well protected from the weather, and we used that Harbour with very great effect.

We were coaling one day, in Swarbacks Minn when a signal was received stating that a suspicious steamer with two funnels and masts, (which was all the description they could give us) was racing full speed for the Norwegian Coast, and passing North of the Shetlands so hurrying out from there (the rest of the patrol were on a line North of the Shetlands) I ordered a general chase. The fugitive rather distanced us at first, but we continued to chase her from about 4 o'clock in the afternoon until about 2 o'clock in the morning, and eventually caught her forty miles from Bergen. She turned out to be the "Bergensfjiord", one of the Steamers of a Norwegian line. We stopped her and sent a boat on board to examine her, and found that she had the German Consul from Korea on board, and probably a certain amount of contraband which we had not time to get at, so we put a Prize Crew on board, and sent her into Kirkwall, a little Harbour in the Orkneys, to be thoroughly examined.

From time to time mine-layers would endeavour to get out from the Elbe to lay mines off Hull, and many Ports on the English Coast. They also tried to lay mines in the vicinity of Scapa Flow, to catch our Grand Fleet. One morning a signal was received that two mine-layers had been seen going through the Fair Island Channel so the "Crescent" and the "Edgar" went off in pursuit and after passing through the Fair Island Channel were caught in a very heavy gale from the Westward; you see by this chart the whole place is open to the Westward, so it did not take very long for a terrific sea to get up, and I must say that I think that the sea we encountered that day was the worst storm I have ever experienced. It swept away the "Crescent's" fore-bridge, and the Officers and men on the bridge had just time to shin down the the mast and get into the conning tower. It carried my sea cabin overboard, it swept away the boats, and the ventilators, it tore the hawser reels out of the deck, the decks opened by the working of the ship, and

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water got below, and put the fires out in the foremost boiler room. All the cabins, and ward room, were afloat, water was rushing about the main deck, and it looked as if the "Crescent" would not survive the storm, in fact we rather feared that she would go down. As a matter of fact by good fortune the gale shifted during the day round to another point, and it blew from the North East, so that the "Crescent" then came under the lee of the Shetlands. The Commander-in-Chief had signalled to us before our wireless was carried away, to run for shelter, but we could not run for shelter, because in a very great storm like that you have to lie to. If you attempt to turn, the chances are that you may turn right over; anyway the seas break over you to such an extent that they make it dangerous. By the wind coming round the sea became very much calmer, and we were able then to steam into Busta Voe, Swarbacks Minn where we repaired damages, and I looked out for the "Edgar" which had also suffered very badly, sustaining great damage and having lost some men; she crawled in afterwards much the worse for wear.

The Commander-in-Chief when he heard that we were faring so badly in the winter gales, was afraid that these old ships of the Edgar class were unsuitable for the work of the blockade, as ships engaged in this duty had to keep the sea all the time, gales or no gales.

Three of these ships were ordered to the Clyde to be examined, and the result of this examination was so surprising, that the Admiralty ordered the seven cruisers of the Edgar class to pay off, and determined to replace them by a large squadron of more suitable vessels, so important did they feel the work of the Northern Patrol to be.

It was decided to take up more Atlantic Liners, and make a very efficient Squadron of them, which could keep constantly at sea, and to man them with the crews of the old Cruisers which were being paid off. Three other ships were at once taken up viz: the "Otway", a P. & O. boat, the "Cedric" a White Star Liner, and the "Virginian". These three ships were armed with 6-inch and 4·7-inch guns, manned by Reserve crews and commanded by Captains of the Royal Navy.

Thus the ships of the old Cruiser Squadron were withdrawn and paid off, and seventeen more modern ships were obtained; besides the three I have just mentioned, and the ports of Liverpool, the Clyde, London, and the Tyne were busy getting them ready for work on the Northern Patrol. As the ships were so large, and as the submarines had made several raids on the Shetlands, the Commander-in-Chief thought it better at first to have our Bases at Liverpool and the Clyde, so 12 of these liners were berthed at Liverpool, and 12 of them were berthed on the Clyde, at Glasgow. An office was established at Liverpool which at first took all the correspondence, and acted as the main Office of the Squadron, the idea being then that these 24 ships when fitted out should work in the Squadron Area, and should come in to coal, water and provision at Liverpool and Glasgow. The difficulty was that they had to pass through the North channel which offered a very suitable place for the German submarines to work, and while we

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were going through there we had many adventures.

I think it was on December 4th I hoisted my flag in the "Alsatian". She was one of the Allan Liners, and a very nice large ship, and as I say she carried so much coal that she could keep at sea for a long time. Before leaving Liverpool we had to change the 4·7-inch guns for 6-inch guns, and we were very much delayed by labour troubles, strikes, and various things at first, as we could not get the workmen to work properly, but we managed to make things very much better later on, and Admiral Stileman was appointed to Liverpool to help at the base as S.N.O.

One cruiser the "Oceanic" was lost in a fog near the Shetlands where there are very fierce tides which sweep round the Islands, and she was swept on to Foula and lost, without loss of life.

On the 22nd December I was able to get away with the "Alsatian", and we first went into Scapa to get further Orders from the Commander-in-Chief, then proceeding to my squadron, I arranged the disposition of all the ships to meet the new conditions. The 24 ships were now divided to form four patrol lines.

No. 1 was on a line joining the Faeröes and Iceland.
No. 2 on a line running due North from the Shetlands.
No. 3 on a line joining the Hebrides and the Faeröe Islands.
No. 4 on a line N.W. from St. Kilda and West of the Hebrides.

The ships worked 30 miles apart steaming, and zig zagging, on the patrol lines at 13 knots, for 3 hours each way, and all turning together at the end of each 3 hours, the idea being that blockade runners coming from the United States, or South America should have to pass through our Patrols, which were so arranged that supposing they passed through one at dark and were not seen, they would pass through the others in daylight and be caught. After we had been at work about three months, the Admiralty sent a very satisfactory telegram to the effect that no ships which they wanted had evaded the Patrol, so that we had caught everything that they required. They also went on to say that no Blockade in History had shown itself so effective as the one which was carried on by the Northern Patrol.

You may imagine that the Germans very soon got to hear of the effects of the Blockade, and sent out their submarines to endeavour to sink as many of the Northern Patrol as they could. Consequently the actual line on which the patrols were working soon got to be known, and it was found necessary to frequently shift these lines 30 miles to the right or left, which, although it did not in any way decrease the efficiency of the patrol, yet made it more difficult for enemy submarines to interfere with our work.

Very shortly after we were on patrol here, news was received that the Head of the Secret Service in Germany, was leaving New York in a ship called the "Bergensfjiord", and that she would probably be endeavouring to evade the patrol by either going North of Iceland, or into the Arctic Circle, or by some other means, and that we were to endeavour to catch her. These ships of the Norwegian American line

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were always trying to evade the patrols and were generally carrying contraband or German subjects, so I spread the Patrols specially for this ship, and at 2 o'clock in the morning of January 10th, 1915, it was reported by H.M.S. "Viknor" the Northern ship on No. 2 Patrol, that they could hear wireless signals to the Northward, and at about 8 a.m. that she had captured the "Bergensfjiord", that she had boarded her, and that Von Wedel and six Germans were on board, that they had seized them and made prisoners of them, and captured all their correspondence. I was with *this* Patrol *here* (pointing chart) and leaving that Patrol I went across to the "Viknor" which had captured the vessel. I received signals by visual, and then ordered the "Viknor" to take the prisoners out of the "Bergensfjiord", and to escort her down to Kirkwall, where she would be properly examined by our Customs for contraband. Having done that the "Viknor" was to leave the Patrol with these prisoners for Liverpool, and the Admiralty would be able thoroughly to examine Von Wedel. All went well and the "Viknor" parted company with the "Bergensfjiord", turning her over to a Destroyer, which took her into Kirkwall, but that was the last we heard of the "Viknor"—she was lost with all hands. It is rather uncertain where she was lost, but I think she must have been either torpedoed, or struck a mine, off the North Coast of Ireland, anyway boats were washed ashore at a place called Portrush. The Germans throughout the War never knew that Von Wedel had gone down, and thought that he was safely interned, they often made inquiries about him, but never got any satisfaction.

I may tell you that often in the boarding of these ships it was very difficult during the winter months to achieve our object —if we take this line of Patrol for instance—the ships would be thirty miles apart; they would be steaming all in one direction turning together and back again, they were out of sight of each other, but they knew exactly where each ship of the patrol was. They were also in wireless touch with other ships, and when a ship passing through the Line of Patrol was captured, the ship capturing her made the signal to the "Alsatian", giving the name of the ship, condition, and all details, and then the answer was generally to the effect that a Prize Crew was to be put on board, and she was sent to Kirkwall.

To give you an idea of the way a ship was stopped or chased, we had in the 10th Cruiser Squadron crows nests on the masts well above the funnels, and we had look-outs up there so that they could see on the clear days (and it is very often very clear weather) a very long distance. We could see the smoke of ships coming up over the horizon some time before they saw us and directly they saw us they usually turned away and tried to escape, but by that time we were working up to full speed and probably caught them very soon. Sometimes it was during a heavy gale, and the weather was so bad that it was impossible for a boat to be lowered, in fact often and often I have witnessed the boarding boats capsized and sunk alongside the craft they were boarding. The way we generally managed to get alongside was to order the ship to

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steer a certain course at right angles, (if the weather was not too bad,) to the wind and sea. Then we would go round ahead of her and with our ship pointing in the same direction lower our boat under our lee, and then steam ahead, ordering the other craft to steam ahead too, and she would come up to where the boat was, so that there was a less amount of pulling, which was almost impossible sometimes in that very heavy weather, and the ship would come up an give the boat her lee, and in that way the boarding party generally managed to get on board. The ship which captured her would then steam round and come up astern ready for the boarding boat when she had finished with the capture. Then the examination of contraband and crew would take place, lasting at times several hours. It would have amused you to witness the various subterfuges practised by the blockade runners to deceive and hoodwink the boarding officers. Hollow masts and double bulkheads filled with contraband, forbidden metals secured to ships sides below the water, sections of honey comb filled with rubber solution, macaroni covering to sticks of aluminium, and one day an officer taking rather a fine onion from a barrel, inadvertently let it drop and was surprised to see it bounce like an india rubber ball, which it was! I had to board one of my ships during a gale, she had been intended for cruising between England and South America, going through the Tropics, thus she was arranged for hot weather and consequently all her water pipes led along the upper deck, and were uncovered. The signal I received was that the water pipes had contracted to such an extent that the gaps between each joint were about half an inch, and covered with ice, and as there were various other difficulties about her, which I wanted to see, I decided to board her. It was blowing very hard at the time and the "Alsatian" was rolling heavily, watching our opportunity we lifted the boat out and dropped her on to the crest of a wave and I sprang in as she rose to the gunwale, the "Alsatian" then went ahead leaving the boat exposed to the full fury of the gale until the other ship came up and gave us a lee. Although the Newfoundland fishermen who formed the boats crew were excellent boatmen, the boat was nearly swamped before I managed to get on board. I tell you this to give you some idea of the boat work during the winter in that Squadron.

In March 1915 the German submarines became very active not only among the patrols, but in the narrow waters leading to our bases Liverpool, and the Clyde. One of the auxiliary cruisers of the 10th Cruiser Squadron proceeding one night from Glasgow with all lights out, was torpedoed and sunk with nearly all hands off Corsewell Point, and the "Ambrose", another cruiser, while on passage to Liverpool was attacked by two submarines off Oversay Island, torpedoes were fired at her which she cleverly evaded, and eventually got clear after having hit a conning tower of one of them. The "Digby", another cruiser, was chased by a large submarine 25 miles South of Skerryvore, but she managed to keep her away by gun fire.

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These little incidents were of daily occurrence, interfering with our work very much, and we had already lost four ships, the "Oceanic", "Clan Macnaughton", "Bayano", and "Viknor", so that the question of having a base nearer our patrol area was again raised. Various ports were suggested and I visited Loch Roag on the West side of the Hebrides, with a view to reporting on its suitability as a coaling base, but none of them appeared to have the advantages possessed by Busta Voe, Swarbacks Minn, on the West side of the Shetlands. It was a better anchorage and capable of being much more easily protected besides the supply of water being more abundant, and so a base was established here which served the ships of the 10th Cruiser Squadron excellently during the remainder of the time the blockade lasted.

During my visit of inspection to this base I found there was room for seven of my cruisers to lie at single anchor, and while in there in my Flagship, the "Alsatian", I was able to carry out a practical demonstration of the value of its central position, for it was here I received a report by wireless that the United States oil tank steamer "Petrolite" had been seen in a certain lat. and long. stearing N.E. She had evidently evaded the patrols to the Westward, so, hastening from Swarbacks Minn at 18 knots the "Alsatian" captured the tanker at 8.30 p.m. and sent her in to Kirkwall with an armed guard.

Many of the blockade runners tried from time to time to pass round the North of Iceland and consequently one or two of our cruisers were stationed there to prevent them getting through. At this time, about the middle of May, I received a signal from the "Alcantara" stating that ice was closing in on the ships of this patrol, and going up there to see for myself what was to be done, I found a large ice floe had drifted from the North, and touching the North shore of Iceland, extended for a great distance in a North Easterly direction.

We sighted this ice floe about 11 p.m. while the sun was still above the horizon, and setting behind the ice, and I must say it was a very beautiful sight as the sun's rays glistened through the ice bergs and hummocks, but intensely cold as the wind was off the ice and the temperature well below Zero. We examined the edge of the ice that night for many miles, but could find no passage so I sent the "Alcantara" over to the Norwegian coast, where we were very busy intercepting ships in the German iron ore traffic between Narvik and Rotterdam.

In June reports of the presence of submarines in the patrol area continued to increase and three of my ships encountered submarines under interesting circumstances.

The "Motagua" off the Flannan-Islands sighted a steamer in a sinking condition with a submarine near having done her work. The "Motagua" drove off the submarine, and saved the crew, but failed to save the ship herself. The "India" was missed by a torpedo some 40 miles North of the Butt of Lewis. The "Oratava" arrived in time to drive a submarine away from a Danish steamer, and escort her out of danger.

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We also had certain armed trawlers working with the patrols off the coast of Norway, and attached to the 10th Cruiser Squadron. The "Tenby Castle", one of these trawlers whilst on patrol sighted a ship called the "Frederick Arp" and promptly gave chase. The "Frederick Arp" ran from her and the "Tenby Castle" fired a shot across her bows and told her to stop. The Frederick Arp" refused to do so, and the "Tenby Castle" with her little gun put sixteen shots into her, she sank and the Captain and the crew were rescued in the water. Shortly afterwards the "India", one of the auxiliary cruisers working up on the patrol off the coast of Norway was sunk by the German submarines which had been sent from Borkum to attack us, but a great many of her crew were saved, and they were landed in Norway and interned.

To show you the sort of experiences the armed guard were subjected to I will just mention an instance :—

The Auxiliary Cruiser "Hildebrand" chased and captured the "Trondhjemsfiord" carrying contraband, and having placed an armed guard on board, under a midshipman R.N.R. sent her in to Kirkwall to be examined. Shortly afterwards the "Trondhjemsfjord" was chased by a submarine and stopped, after being overhauled and fired at. The Master was ordered on board the submarine, and as there were none of our cruisers in sight the Master had perforce to obey, but before leaving his own ship he made arrangements for the disguise of the armed guard. When the Master arrived on board the submarine, the German Officer made the signal to the steamer to "abandon ship", and as soon as the boats were clear fired a torpedo and sank her. A large portion of the cargo of the ship was sulphuric acid, which burst with a loud explosion.

While on board the submarine the Norwegian Master denied that he had ever been boarded, and the Master's wife provided the midshipman with some of her husband's clothes, carrying his uniform in her bundle of effects to the boats, which probably saved his life.

About this time in order to show the Neutrals that the Allies were working with us with regard to blockade policy, France was asked if she would join in the Northern Patrol, and she said she would send two ships. The ships told off however were too small and unsuitable for the work so we gave them two of our ships, one called the "Digby", which they named the "Artois", and the other the "Orepesa" they named the "Champagne". They came North from Brest in November, 1915, and worked with the 10th Cruiser Squadron and after a time the French got quite good at it. At the end of 1915, to give you a sort of idea of what happened in the Squadron, we had intercepted, chased and examined at sea 3,100 ships and out of those 743 ships with contraband on board were sent in to Kirkwall with prize crews, but a great many of those were released by orders from the Foreign Office so that obviously we were very much dissatisfied about it. To give you an idea also of the work of the ships throughout the year take the "Alsatian" alone out of 365 days in the year she was 262 days at sea, steamed 71,500

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miles, and burned 46,000 tons of coal and that is very typical of the rest of the Squadron patrolling without intermission an area of 220,000 square miles in all weathers and in submarine waters.

During that year two of the auxiliary cruisers were lost by torpedo attack (the "Bayano" and "India"). The "Clan Macnaughton" was lost in a heavy gale. The "Arlanza" was mined in the North, and the "Viknor" lost with all hands.

I am afraid the time is getting on and I have only a few minutes more, but there was one little incident relative to the 10th Cruiser Squadron which I must mention before I stop, viz : with a fight between the "Alcantara" and a German Raider. Of course we were always on the look out for raiders getting out, and they were very cleverly fitted out in Germany. Now the ships of the 10th Cruiser Squadron were warned that, when they boarded a ship they were to be very careful to ascertain if she was a raider, but on no account to let her escape, and they were also to inform their next number on the Patrol when they were going to board a ship in case aid was needed. One morning the "Alcantara" stopped a merchant ship (as she thought) steaming near Norway; she came up to within 4,000 yards of the steamer and signalled to her to stop. Then the "Alcantara" signalled "What is your name", and the reply was "The Rena"; then she was asked "What is your cargo"? and the answer was "Coffee"; then "Where are you from?" and the answer was "From Buenos Aires". Then the Captain of the "Alcantara" looking up Lloyds Register, found there certainly was a ship of that name which should have been in that position on that day, from Rio. The "Alcantara" closed to examine her and still she looked like a very innocent merchant ship flying the Norwegian Flag, and with Norwegian colours painted on her side. The "Alcantara" came up astern of her to within about 1,000 yards and signalled "I am going to board you". As the boat was being hoisted out, the wheel house, of the merchant ship, fell down like a pack of cards revealing a gun and the first shot at the "Alcantara" went between the Capt's. legs and killed the helmsman, but I am glad to say that the "Alcantara's" crew were absolutely ready at their guns and immediately fire was opened on this craft. In the meantime other guns were rapidly being uncovered and torpedoes being fired from this peaceful merchant ship, and a little action of about 35 minutes took place until both ships were disabled, but the German crew abandoned their ship which was on fire half-an-hour before the "Alcantara" sank. She turned out to be the German Raider "Greif", and had been fitted out in the Elbe as a Commerce Destroyer for the Atlantic. The "Andes" arrived on the scene in time to assist in the action and was able to save the crews of both the "Alcantara" and the "Greif". I think 116 prisoners were picked up.

From 1914 to 1917 the greatest strength of this squadron was 25 Armed Merchant Cruisers and 18 Armed Trawlers. The losses during that time from submarine, mine, tempest, and battle consisted of 11

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ships, namely:—H.M.S. 'Hawke', 'Oceanic', 'Viknor', 'Avenger', 'Clan Macnaughton', 'Bayano', 'Alcantara', 'India', 'Otway', 'Hilary', and 'Champagne', and trawlers 'Robert Smith', and 'Thomas Stratton'.

The total number of vessels intercepted and examined at sea, and sent in with contraband on board, by the ships of the 10th Cruiser Squadron were as follows:—

Year.	Number intercepted and examined at sea.	Number found carrying contraband and sent in with prize crews.
1915	3098	743
1916	4148	1230
1917 to 30th Sept.	1333	190

Now I am afraid I must close because it is 6 o'clock, though I have to omit much that I could have told you.

(Loud and continued applause).

THE CHAIRMAN: Has anyone any questions they would like to ask the Lecturer before he goes? The Lecturer is rather anxious to catch a train, and the questions should be kept as short as possible.

As there are no questions it only remains for me to thank the Lecturer very much for his very interesting Lecture. We go away with a very graphic picture of what the Northern Patrol has done and the dangers they have gone through, and I ask you all to show your appreciation in the usual manner.

(Loud and prolonged Applause).

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THE DEVELOPMENT OF ARTILLERY TACTICS—1914—1918.

BY LT.-COL. C. N. F. BROAD, D.S.O., R.F.A.

CHAPTER I. 1914.

THE 72 Field and 6 Heavy batteries which accompanied the British Expeditionary Force to France in 1914, expanded, by November 11th 1918, to 568 Field and 440 Heavy and Siege batteries.

The artillery also, in actual battle, increased in proportion to the other arms. It thus ceased to be a subsidiary arm and, in time, grew to such a proportion of the fighting forces, as to have a very vital bearing on the course of the war.

It is with the development of tactics due to these factors that the following chapters will deal.

Tactics before the war usually meant the fire and movement of infantry supported by such artillery as was available; one of the main essentials being a large infantry reserve. The battles of the Russo-Japanese War offer a very instructive study in this connection.

With certain modifications the same holds good to-day, either in the early stages of a big continental war, or in a campaign such as that in Palestine in 1918.

In the late war in France, tactics had, however, a different meaning.

It then meant, almost entirely, the fire power of artillery, machine guns, tanks and aeroplanes. The infantry, although no less essential than in 1914, being in comparatively small numbers. These small parties worked in co-operation in matters of minor tactics, but could not be influenced in their action from the rear, either by orders or by reinforcements.

The control of the commander lay almost entirely in the use he made of his fire power; although his measure of success often depended on the initiative displayed by junior infantry commanders in making use of the opportunities he had created.

This statement applies not only to the pitched battles of 1916-17 and 18 but also to the so-called open fighting shortly before the end. Towards the close of 1918, we had small glimpses of really open warfare when the enemy was retiring, but they were usually brought to a very abrupt conclusion once the enemy had established a new line. The tactics of "fire" had then to be again resorted to.

Therefore to the commander of the future, the study of artillery tactics is as important as those of his infantry, machine guns, tanks, etc.

Artillery tactics in principle do not differ from that of other arms.

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There are perhaps three main things which the artillery tactician has to study.

i. He requires a detailed knowledge of the organisation, capabilities and limitation of the various arms.

There is perhaps more to learn about artillery, machine guns, tanks and the Royal Air Force, than there is about infantry; or perhaps one should say that the majority of people know more about the latter, than they do about the former.

You do not, of course, need to know the technical capabilities and limitations, but those concerning tactics. Technique cannot be entirely divorced from tactics in artillery, but you need only know such technique as bears directly on tactics.

For instance, you do not need to know the calculations which a Battery Commander makes when in action, but you do need to know that survey sections, meteor, thermometers, barometers, etc., are as essential, in certain cases, to effective fire, as shell to put into the gun and men to pull the lanyard; moreover for an intelligent application of this knowledge, the commander must know generally why these items are essential, just as much as common sense tells him that the guns will not go off unless there are shell to fire and men to work them.

ii. He requires a good working knowledge of the organisation, equipment and tactics of the enemy.

The main points which the artillery commanders studied in France were perhaps :—

(a) The German divisional organisation; especially the changes in the strength of the field and heavy artillery included in the division; the organisation of heavy artillery other than that in the division.

(b) The hostile artillery tactics and tendencies in detail.

(c) Machine gun tactics and the distribution of the hostile machine guns on the battlefield.

(d) The method by which the hostile infantry held the line and the use and location of infantry reserves and, in fact, reserves generally.

iii. The third big point is the study of the mentality of the opposing commanders.

This is always difficult in artillery matters, as it is the custom in both our own and also the continental armies to conceal the identity of the artillery commanders under the signature of a general staff officer.

General Ludendorf was credited during the war with profound thought in artillery matters, but he was equally profound as regards infantry, engineers, machine guns, cavalry, etc., and if we are to go by his signature, he also

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had time to think out the daily situation report, which we received with unfailing regularity on our breakfast tables!

The late General Sixt von-Arnim was equally instructive and prolific, so that it was obviously waste of time to study these gentlemen, not as to their stuff, but as regards their mentality.

In matters changing so rapidly, as the artillery did in tactics, you really required to get at the brain which originated the thought and that, we rarely succeeded in doing. In default we could only study general tactics and tendencies, which, in an army so well organised and disciplined as the German, and moreover, with such a decentralised artillery command, to a certain extent made up the deficiency. It, however, made any attempt to forecast the probable trend of future developments, a matter of great difficulty. That, usually, was only obtained by battle fighting on a large scale. Even then one was completely ignorant concerning the training, education, experiences, and other characteristics of the brain which was leading any new development.

Before we proceed to a detailed consideration of the subject, I should like to summarize pre-war and 1918 artillery tactics, so that we can see at a glance the chief points of difference i.e. the subject we are really going to study.

As I have already pointed out, artillery before the war was a subsidiary arm, not only without any great power of its own, but very few people visualized its possibilities. There was a good deal of loose talk about the power of modern artillery but we, at least, did not take any definite steps to translate these words into deeds.

Very shortly before the war we were engaged in reducing a certain number of batteries, as these units were in excess of what was required for the Expeditionary Force organisation and for finding the Indian and Colonial drafts. The possibilities of heavy artillery in the field, barring the 60-pounder, were not seriously considered. The idea was held, I believe, that only artillery that could be landed on an open beach was permissible in a "Field Army". At any rate the 6″ howitzer batteries, then in existence, did not form part of the Field Army as in the German service. It is interesting to point out that the Russo-Japanese war turned the attention of the gunners to the importance of heavy artillery; at least, that of the Royal Garrison Artillery branch. Nevertheless, regarding the 6″ howitzer, Garrison Artillery Training 1906 stated, that it was intended, in addition to being available for use in a siege, they should be utilised, if required, for use in the Field.

In a lecture at the Royal Artillery Institution in 1908, a Royal Garrison artillery officer stated that the uses of Heavy artillery in the Field were as follows :—

i. To silence at long range, hostile guns that may command lines of advance.

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ii. To search and enfilade points which the lighter guns can only reach with frontal fire.
iii. To destroy villages and houses held by the enemy.
iv. In the final stages of the attack, to support the firing line.
v. In pursuit, for harrying the enemy's main body at long range.

The lecturer concluded by saying that he hoped that means would be found for associating these howitzers with the Field Army, so as to familiarise all ranks with their duties and to accustom Generals and staff officers of other arms to their employment in the combined tactics of the battlefield.

The devastating power of quick firing field artillery was realised, but somewhat exaggerated, as the ammunition problem was not seriously tackled. You cannot devastate if you are counting shell all the time. I do not know that we have advanced much, as our field artillery ammunition supply is now rather more meagre than it was in 1914. Full value will not, of course, be obtained from the artillery in open warfare until an adequate ammunition supply is provided.

Another great cry before the war, was mobility. In war time, people want shell power, in peace time, mobility. It has been the same since time immemorial.

In war, however, guns rarely trot.

Artillery tactics, therefore, consisted largely of manœuvre, designed to facilitate the projection of bursts of fire, as far as ammunition permitted, which were intended to assist the infantry in their fire fight with the enemy, and so facilitate their movement.

Now to turn to 1918. Let us examine the main features of artillery tactics at that time.

i. The artillery and machine guns obtained fire superiority without a long and exhausting fire fight on the part of the infantry. The latter were thus enabled to penetrate several thousand yards into the enemy's position, at the same time preserving their energies and their ammunition for exploiting the advantages already gained.
ii. Counter battery work had evolved into an elaborate science, designed to obtain fire superiority over the enemy's artillery so that
   (a) The barrage batteries could carry out their duties against the enemy's infantry and machine guns.
   (b) The advance of our infantry was not made impossible or costly by the hostile artillery.
iii. Bombardments of great intensity, either long or short, designed to destroy the enemy's infantry, artillery and machine guns, so that our infantry could pass through and reap the fruits of victory.
iv. Continuous harassing fire, both by day and night, to prevent the movement of the enemy's reserves and replenishment of ammunition.

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v. Unlimited ammunition, and hence the dust and smoke of a modern battlefield, necessitating mechanical aids and increased science to replace terrestial observation.

vi. Finally surprise and deception, the really big thing in war, did not lie wholly in the placing and use of the "general Reserve" as contemplated in Field Service Regulations Part I, 1912, but rather in the methods employed in the use of the artillery masses.

The chief points of difference between 1914 and 1918 may be summarised as follows :—

i. In large attacks the infantry in 1918 were not required to provide their own covering fire.

ii. Artillery fire in 1918 battles, was largely unobserved on account of the dust and smoke.

iii. Counter battery work was almost impossible before the war as there was no aeroplane observation.

iv. Continuous firing and the effect of harassing fire is a new feature in war.

v. A commander by proper use of his artillery can both mystify and deceive the enemy.

I would now like to make my first point.

It is that modern grand tactics are largely a correct use of artillery; and furthermore, if we are to develop these tactics on the right lines in peace-time, we must have a good knowledge of the various forces and re-actions which have brought us to our present state of evolution.

I propose to study each year of the war in detail. At present, of course, a lot of evidence remains to be sifted, but even so, a statement of the various situations that confronted us and the means taken to overcome them, made while the facts are still clear in ones memory is probably of value, as showing the tactical train of thought at the time, which must after all be our basis for future study.

Before the end of 1914 four big points had cropped up, these were :

i. The introduction of the medium howitzer by the enemy and later by ourselves.

ii. The real superiority of the 18-pounder, with all its faults, as a man killer over all other continental field gun equipments.

iii. The introduction of universal night firing.

iv. And last, but first in importance, the use of wire on a large scale.

These are all big points and each had an important bearing on the future course of artillery tactics.

To take them in order.

i. The introduction of the 5·9″ Howitzer as a horse drawn field piece was a complete surprise to, at any rate, the mass of the army. It outranged everything we had, except the 60-pounder and could occupy positions safe from the fire of

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these guns on account of their flat trajectory. Its shell power was greater than anything we had expected to meet.

To my mind the enemy obtained a moral advantage at that time which remained with him until the end of the war, and which was chiefly due to the effect of the 5·9″ howitzer in 1914. I refer, of course, to the manner in which the enemy fought for observation right from the beginning and to the persistance with which our minds stuck to the idea, first germinated in 1914, of getting our most advanced lines on to reverse slopes and thus giving up all observation, and incidentally, very often gun positions as well.

The 1914 line, i.e., the Ypres heights, Messines, Aubers Ridge, Notre Dame de Lorette, the Somme, etc., shows nearly all the dominating ground in the hands of the enemy; in some cases only obtained by hard fighting.

The result of this was that gun positions were exceedingly difficult to find, and later on our batteries went into action (practically speaking) in the open, or huddled together in the few available valleys.

The Somme valleys in 1916 often held four tiers of field guns. In 1917 practically no flash cover was available in the Ypres salient at the commencement of the battle.

The moral effect of the 5·9″ remained with us even in 1918. The trenches hurriedly dug across France in April and May of that year were often sited on reverse slopes; all the observation being given up to the enemy.

These views first made their appearance in the war, in a pamphlet published on October 30th, 1914. The author therein states:

"Your trenches must be sited on the backward slopes, and they must be concealed, not only from the artillery fire itself, but also if possible, from observation by the observers so that the artillery fire cannot be directed on them."

"Leave yourself anything over 100 yards field of fire."

The author is not very clear in his meaning as regards the artillery fire, but the moral effect of the 5·9″ is very clear.

The reverse slope in 1914 was a tactical disadvantage forced upon us as a penalty for going to war with an artillery inferior in range and shell power to that of the enemy.

Although the artillery situation had been reversed long before 1918, the moral effect of our initial mistake remained with us up to that year.

ii. The comparative failure, on the other hand, of the German 15-pr. field gun and the successes gained by the British 18-pr. had far reaching results.

On certain occasions, during 1914 the line was held in places by the fire of 18-prs., even after the infantry in front had all been placed "*hors de combat.*"

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The masses in which the enemy advanced, made themselves particularly vulnerable to shrapnel and firmly established the 18-pr. in its position.

This was a great advantage to us, as manufacture could proceed on a well known and well tested type of gun and no wastage or delay occured through changes in construction.

The enemy on the other hand was inclined to develop along howitzer lines on account of the success of the 5·9″s. So that when the day arrived in which attacks were made under artillery covering fire alone, or barrages as we call them, the Germans suffered under the disadvantage of not being able to get close to their howitzer barrage. They had field guns in the barrage but never enough to make field gun creeping barrages as we did.

iii. The introduction of night firing as a normal procedure was a new feature in warfare and from this evolved the following:
(a) Harassing fire.
(b) The S.O.S.

Both were going in a modified form in 1914. Harassing fire was carried out as far as ammunition permitted. Some of the approach trenches before Neuve Chappelle were dug under cover of specially ordered harassing fire or night bombardment; guns being placed in specially selected positions for the purpose. The S.O.S. was not known as such, but batteries were prepared to fire on night lines, if rifle fire broke out in an intense fashion from the front line.

The former developed into a very important tactical feature in all our battles and was of great assistance to us, but the latter caused enormous waste of ammunition and in 1918 became a positive danger to us. I will deal with this at length later on.

iv. Finally we come to wire. Thick belts of wire were a new feature in field warfare, as it had been held that its use would be limited to what could be gathered locally. Its immediate effect was to stabilise the front. It had however a greater tactical effect even than that. For a long time strategical surprise was an impossibility. The wire had always to be cut before an attack, and since it could not be cut in a serious manner all along the front, the real zone of attack was fairly clearly defined.

The introduction of tanks again made the strategical surprise possible, and ended for us the era for wire. The Germans never suffered from our wire as we did from theirs. If they had, the tactics of their attacks in 1918 must have been very different to those employed. No infantry ever dared to attack successive belts of steel wire without either previous cutting or the aid of tanks.

Another effect the enemy wire had on us was over bombardment. So long as any wire showed on a photo, the artillery was kept on cutting.

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The size of the zones of the various wire cutting equipments was not so well known to the general staff in those days as they are to-day, otherwise possibly it would not have been done; but it grew into a habit and as it generally rained during battles, it produced the fifth element, mud; which offered a more effective resistance to our advance than anything the enemy ever did.

We are thus, by the end of 1914, beginning to see standing out some of the main factors on which our tactics developed.

i. Our faith in the field gun.
ii. The power of the enemy howitzers, and hence our counter by bigger and more numerous howitzers.
iii. The power of wire and hence the introduction of the tank to make surprise possible.
iv. Our bid for superiority in moral by the extended use of harassing fire and in fact the almost continuous artillery offensive right up to the end of the war.

CHAPTER II. 1915.

1915 was a year of growth, training and experiment and laid the foundation of the tactics of later years.

Beginnings were made in many things such as attack barrages, counter battery work, centralised artillery command, aeroplane co-operation, sound ranging and flash spotting, but neither the time nor the material was available in order to produce successful solutions to the artillery problems of that year. It is therefore not to be wondered at that the artillery and infantry co-operation, which was one of the great features of 1916, was largely absent during this year.

The attacks were very costly, as we all know, which fact can, I think, be ascribed to the endeavour to force a decision by man power without first obtaining superiority of fire.

Four points stand out in 1915 which had great influence on the development of our tactics.

i. The power of the German machine gun.
ii. The strength of the German artillery, which was still more powerful than our own.
iii. Our divided system of artillery command.
iv. The very limited ammunition supply.

The German machine guns swept away attack after attack and were as effective at Loos as in the earlier battles of the year. The field artillery covering fire lifted from trench to trench and through inexperience of map shooting sometimes missed the trench altogether.

This led to the creeping barrage which was used on at least one divisional front at Loos.

The "yards to the gun" varied a good deal during this year, which points to the fact that the artillery was still considered a subsidiary arm.

At Neuve Chapelle we had one 18-pr. every 6 yards; at Loos, one every 40 yards.

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The difference in the casualties of the first attack in each case was what one would have expected in later years.

Counter battery work in 1915 was in a very rudimentary state. It was carried out by the divisional artillery, various formations of heavy artillery, R.F.C. and field survey companies, all working on their own, without any appointed co-ordinating authority. Beginnings, however, were made, which evolved into the counter battery staff officer of 1916.

The artillery organisation at the battle of Loos was as follows :—

i. Field artillery under divisional control.

ii. Brigades Royal Garrison Artillery (60-prs. and 6″ howitzers) under corps control.

iii. Heavy artillery reserve allotted by General Heaquarters to Armies (6″ guns and heavy howitzers).

There was no official appointment of a General Officer commanding Royal Artillery corps, or a corps heavy artillery commander. Consequently it was exceedingly difficult to co-ordinate the operations of the infantry, field artillery and various forms of heavy artillery; or to insure that the counter battery work carried out was that most calculated to assist either the infantry or the rest of the artillery in the actual battle.

The amount of ammunition expended in the battles of the year made the result almost a foregone conclusion when compared with what was required to achieve success in 1916.

The comparatively small expenditures were due to the fact that ammunition did not exist in sufficient quantities to achieve the object in view.

The lesson was therefore learnt that it is hopeless to engage infantry in battle unless the requisite amount of gun ammunition is available. If this amount is not in the country or through difficulties in transportation is not at the guns, then the battle must be postponed. In other words, it is just as important for a modern commander to count his shell as his bayonets.

The following figures emphasise this point :—

Date.	Battle.	18 Pounder.	6″ Howitzer.
Sept. 25th	Hooge, 1915	100 R.P.G.	—
Sept. 22nd 23rd 24th	Hooge, 1915	33 R.P.G. per day	—
Sept. 25th	Loos, 1915	—	About 200 R.P.G. whole operation including 4 days bombardment.
Sept. 15th	Courcelette, 1916 ...	235 R.P.G.	50 R.P.G.
Sept. 15th 16th 17th	Courcelette, 1916 ...	146 R.P.G. per day	52 R.P.G. per day
Nov. 13th	Beaumont Hamel, 1916	270 R.P.G.	185 R.P.G.
Nov. 13th 14th 15th	Beaumont Hamel, 1916	216 R.P.G. per day	116 R.P.G. per day

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The quiet times of 1915 provided very favourable soil for the cultivation of the S.O.S. which in point of speed attained great proficiency.

Although extremely wasteful of ammunition and energy, this form of the S.O.S. in the great battles of 1916-17 at times achieved its object in withering local counter attacks.

In the defensive battles of 1918 it was destined however to rob the artillery of all offensive power, since the presence of a German reconnoitring patrol, in those anxious times, was sufficient to cause the S.O.S. signal to be sent up.

The artillery, in consequence, was automatically taken from counter preparation i.e., offensive action against the enemy's assembly, to carry out a useless ploughing up of "No Man's Land".

By the end of 1915 we had reached the following state of development.

i. Artillery covering fire had practically replaced rifle covering fire. The infantry, however, had not learnt to hug the barrage or to form a tactical offensive with it.

ii. Although the appointment of General Officer commanding Royal Artillery corps had been made, it was cancelled before the end of the year. The absolute necessity of some executive authority to control the various operations of the growing masses of artillery within the corps, made the return of the appointment a practical certainty.

iii. The pre-war standard of so many guns to the 1000 infantry was being upset. We were beginning to look at the difficulties before us, and to calculate the fire power which was required to overcome these difficulties.

This gradually evolved, as regards the 18-pr. into the so many yards per gun standard.

There is, perhaps, nowadays a tendency to regard any chosen figure in that standard as a kind of Ju Ju to insure success, forgetting that it was never more than an average on a certain standard of defence i.e. the German in France.

iv. Counter battery work was recognised as a separate tactical operation of the artillery, requiring special organisation. The way was thus cleared for the temporary organisations prepared for the Somme, which later consolidated in the creation of a regular counter battery staff.

CHAPTER III. 1916.

1916 was a year of great development. This was made possible by the experience gained in 1915 and by the increased resources in guns and ammunition.

The preparations for the Somme began in April. Elaborate but unsuccessful attempts were made to keep it secret. The assembly of the artillery was made by night and fire was carefully regulated to cover the registration.

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Elaborate measures were, however, taken to protect the batteries from the German artillery; overhead cover being constructed for even 60-pounders and 6-inch howitzers. This was due partly to the fear that the German artillery would interfere with our bombardment; partly to our lack of confidence in the real efficacy of counter-battery work, and also largely to the fact that many of our positions were devoid of flash cover. The latter was, of course, due to the fact that the enemy held all the high ground. This extensive protection fell into disuse later on, as it was found that it gave away the battery positions; and that it was better to depend upon camouflage of the actual position, combined with the provision of dug-outs in the vicinity. Elaborate arrangements were also made for the protection of observation posts and their telephonic communications. It was impossible to construct separate observation posts for all batteries, so that arrangements had to be made by the corps for batteries to be alloted to a certain observation post, and a certain battery to be made responsible for its maintenance. This practice was quite valuable in certain cases in bringing the heavy and field artillery together.

The difficulties in organizing the communications for all this artillery, without complete expert supervision was one of the chief causes which led to the provision of the various artillery signal units and to their eventual taking over by the Signal service. The heavy artillery communications for the Somme, were laid out entirely by artillery officers, except in those cases where good liaison had extracted an officer from the corps signal company.

The chief points in the artillery plan of attack were as follows :—

i. 5 days bombardment (increased to 7) in order to destroy machine guns and strong points, and to cut wire.
ii. Counter-battery work of an intensive character during the bombardment.
iii. Continuous harassing fire.

Arrangements have to be made in a bombardment of this nature for the hostile area to be divided into zones of a suitable size, say 500 yards × 500 yards, according to the locality, range, etc., so that fire may be observed. These sub-areas are allotted to units at certain hours during which time all other batteries are warned off. The wire was cut by this means, but the bombardment by aerial observation was not entirely satisfactory. This was due partly to the lack of practice in observation on the part of observers but chiefly to lack of experience in the organisation of this class of fighting.

This greatly improved in 1917 owing to more efficient staff work. These programmes require very good staff work, as they are long and full of detail, much of which has to be filled in for the next days shooting after the effect of the preceding day's fire is known or can be judged. The work has therefore to be both quick and accurate.

Counter battery work was carried out by means of shoots observed from the air. Failures due to lack of experience, bad staff work, and faults in wireless were fairly frequent, and the efficiency of the work

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varied a good deal. Howitzers were beginning to be used for this work but the 60 pounders were the rule for neutralisation. Concentrations were also initiated.

Harassing fire was kept up really continuously for 7 days and had an over-powering effect. The enemy were confined to their dug-outs, and it was only the magnificence of these, which saved them from annihilation. Battle harassing fire was successfully used on the day of attack. A case is on record of a certain German battalion which detrained one morning at Bapaume during the first few days of the Somme. During detrainment two carriages were hit by a 12-inch gun engaged in battle harassing fire. The battalion then advanced down the Bapaume—Pozieres Road. Considerable losses were suffered during this advance, first by 6-inch guns, then by 60-pounders, and later by 18-pounder harassing fire. At Pozieres the battalion took to the communication trenches and advanced towards Fricourt, losing men all the way. The commanding officer and the remains of his battalion—some forty men—were eventually captured about 4 p.m. the same day in Railway Wood, a short distance East of Fricourt.

The attack on July 1st was supported by an 18-pounder per 25 yards and a heavy gun or howitzer every 58 yards. It was therefore the first battle fought under modern conditions of size, frontage, number of troops employed etc. Consequently the study of this battle produces many points which had a direct bearing on the future tactics of the campaign, and formed the real foundation, on which modern artillery tactics are built up.

The creeping or rolling barrage, as it was called at that time, came down in No Man's Land and then lifted on to the front line trench. The lifts were then made from trench to trench on a time table. If the space between the trenches was considerable the fire raked back at such a pace as would keep it in front of the infantry. The barrage was really made by the division, the corps laying down the times of the main lifts. This caused difficulties; as the Corps, in laying down points of junction, had to consider the whole barrage; so that very shortly it became the custom for the Corps to issue complete barrage orders. Considerable difficulties were encountered at the flanks of Corps, as Corps were expected to agree amongst themselves as to their barrage lines. Later on this was overcome by the issue of Army barrage maps giving the main timings; but nothing of this kind had been started by July 1st. The heavy artillery during the barrage was employed in bombarding trench lines well behind the rolling barrage, and in neutralising counter-battery work. This bombardment lifted back from trench to trench but had no idea of creeping about it.

Where failure occured on July 1st, it was generally held to be due to one or more of the following three causes :—

i. Undamaged hostile machine guns in heavily concreted emplacements.

ii. Hostile machine guns being unneutralized on account of the

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pace of the barrage being too fast. In certain cases the pace expected was very optimistic.

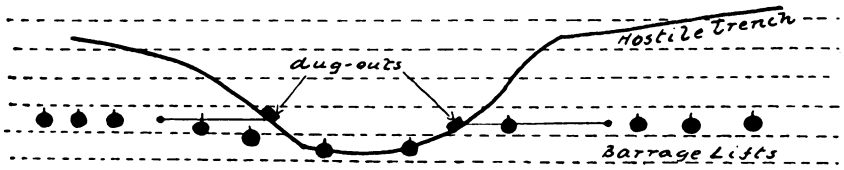
iii. Ineffective counter battery work during the bombardment period which occasioned very heavy losses amongst our infantry during their assembly.

The hostile machine guns were at first, of two types but by September 1916 three had appeared; viz :—

i. The machine gun in a heavily concreted emplacement.
ii. The machine gun which waited in a deep dug-out till the barrage had passed and then appeared.
iii. The machine gun placed in a shell hole outside the trench, at first solely with a view to avoiding our barrage and bombardment.

The first kind had been known in 1915 and organisation existed for spotting it. With the influx of heavy howitzers we were well provided with the means of dealing with it. After July 1st they did not give much trouble on the Somme. The machine gun in a deep dug-cut was a new proposition and led to the perfecting of our present method of attacking under a barrage. The infantry, at this time, were not imbued with the necessity of keeping close to the barrage. Special training was started for this purpose and also the form of the barrage was reviewed. It was necessary to keep the trench, about to be attacked, under fire along its whole length since it was not always certain, at that time, where the dug-outs were. We thus required an 18-pounder every 25 yards as this is the average spread of the bullets from one shell. Practice barrages could be indulged in, and the line of each gun was thereby established with great accuracy. This system further evolved into letting the infantry into the objective trench at the same time along its whole length for the following reasons :—

Straight Barrage.



When the barrage rolled straight back, it was found that some dug-outs were always in such a position that they were comparatively free from our fire and yet unassaulted by our infantry. The enemy then manned their machine guns and by firing to a flank wiped out our advancing lines.

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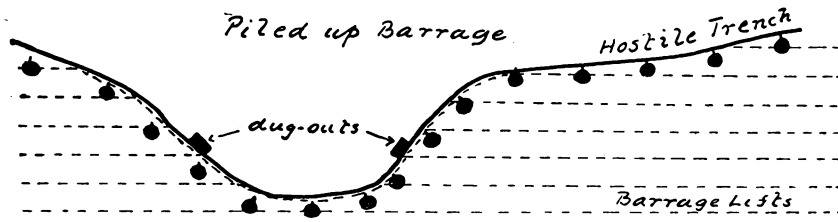

The barrage was piled up on the trench to be assaulted. Those infantry destined to assault the extreme salient, lay down until the whole trench line was ready to be attacked. The whole trench was then assaulted at the same moment. All the hostile dug-outs were thus kept under fire until the last possible moment, and all attacked simultaneously.

The point to be noticed is that this piling up of the barrage on an objective was designed to meet the special form of fortification which was before us at that time and is no argument for barrage of this nature being required under other circumstances.

The actual moment of attack was concealed by care on the part of the infantry as regards noise, showing of bayonets, etc.; and on the part of the artillery by firing in such a manner as either not to alarm the enemy right up to zero, or else by a series of feints to deceive him into crying "Wolf". In this manner, towards the end of the Somme, it was possible to bring off small operations with no casualties outside the enemy's trenches.

The machine gun in the shell hole appeared towards the end of August 1916. This led to the creeping barrage being established across the whole front as the normal method of attack and to the standardisation of the 100 yards lift. It was impossible to locate these machine guns accurately, as they came out of the trenches to avoid our bombardment of the latter. The enemy were also losing faith in the deep dug-out, as the close co-operation established between the infantry and the artillery by means of the piled up barrage merely made the dug-outs so many traps for the trench garrison. It was therefore necessary to sweep the whole ground both before and during an attack. This was done with shrapnel, as it was found that the bullets got down into the shell holes better than high explosive. It is interesting to note, that in 1917 the French in Flanders, came to use shrapnel for this purpose, in spite of the disadvantages of their equipment. I do not propose to enter further into the shrapnel and high explosive controversy, as each projectile has its special uses, and neither will fulfil all requirements.

A careful examination of the ground after certain attacks at this time, notably Courcelette September 15th 1916, established the fact that 100 yard lifts at 100 yards in 3 minutes, were perfectly efficient

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in searching the whole terrain passed over. The enemy machine gunners were found dead in their shell holes, killed by shrapnel, and the cases were evenly distributed over the whole area in such a manner that the spread of the bullets must have searched every shell hole. From this time forward 100 yards became the normal lift in all attacks, except when it was necessary to pile up on the objective. Then, of course, the exact range had to be put on in order to get the mean point of impact onto the target.

Attacks at this time were commonly made at 100 yards in 3 minutes, becoming slower as the Autumn advanced and the ground became more sodden. I do not think that they ever got slower than 100 yards in 5 minutes during this year.

This matter of pace is a very important one. Too fast a pace causes the barrage to run away from the infantry, and the automatic co-operation between the two arms ceases. Too slow a pace causes more ammunition to be fired than necessary. The battle may have been postponed 24 hours to collect this extra ammunition. This respite may very probably enable the enemy to resist an attack, under which he would have broken down 24 hours previously.

In 1917, as will be shown later, the increased slowness of our attacks enabled the enemy to evolve a system of counter attack, which started automatically from our zero hour!

The whole question of barrages was thoroughly thrashed out this year.

The result may be summarised as follows :—

i. The Corps must settle the main timings and lifts of the barrage. Within these limits, Divisions settle their own details.

Any other system led to continual conferences and bickerings between Divisions, with consequent loss of time.

ii. The barrage map must be printed or hectographed by Corps in sufficient numbers for all requiring it. This again is a time saving device.

iii. Before the Corps can do the above, Divisions must state their wishes regarding :—

(a) The infantry forming up line.

(b) The pace of the barrage.

(c) The time they want to wait on the various objectives.

The Corps Commander gives a decision in any case of disagreement and the final decision on the above three points is given to the General Officer commanding Royal Artillery Corps. The barrage is then prepared and printed.

Matters did not go so smoothly as the above in 1916 for the following reasons :—

i. The infantry did not at first realise that slight alterations in the forming up line, could throw out the whole barrage with consequent loss of efficiency.

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ii. The above three points were not always settled sufficiently early for the barrage orders to get to batteries in time for an efficient barrage to be prepared.

iii. The infantry also did not realise that an overestimation of the speed of the attack, is worse than an underestimation from the point of view of accuracy of fire; since in the former case a few shell have to be added at the last moment to each lift.

The battles in the Autumn (Beaumont Hamel) saw the introduction of the heavy artillery into the creeping barrage. Corps control was now a real factor. Co-operation in the attack between infantry and heavy artillery became a possibility so that from now onwards, we find the heavy artillery firing up lanes exactly in the same manner as the field artillery. The advantage of this lies in the fact that the objective is subjected to a much more prolonged and continuous fire than was the case formerly, when only the field artillery were used in the actual attack barrage.

During this time counter-battery work greatly improved and was established on modern lines. To get efficient work, you must have an office or Headquarters whose definite responsibility lies in the defeat of the enemy's artillery; the C.B.S.O. therefore came into being. His headquarters must consist of two parts; the operations branch and the intelligence branch.

As I have pointed out before, we had various organisations studying the hostile artillery, with no real co-ordinating authority. About this time great advances were made.

i. The Counter Battery Staff Officer made himself responsible for the enemy's artillery.

ii. The headquarters of the sound ranging section and observation group were located either with or close to the Counter Battery Staff Officer, so that all their information was immediately available for the man who wanted to use it.

iii. An artillery officer was sent to the Corps squadron Royal Flying Corps for the purpose of examining pilots and observers immediately after landing and for telephoning this information at once to the Counter Battery Staff Officer.

iv. The artillery intelligence service started at Corps and Army headquarters in order to provide a co-ordinating centre for for all this information and to make the required deductions from it.

v. Trust was established in these various organisations by the fact that the General Officer Commanding Royal Artillery of the army made himself responsible for the various lists and maps, which were sent out. He was enabled to do this by his own "I" staff and that of the field survey company, working in the closest co-operation, often in the same build-

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ing, although at this date he was not officially held responsible for having any cognisance of the fact that the hostile artillery existed.

Counter battery work developed during the first battle of the Somme, into its present three main tactical divisions.

i. Shoots for destruction with aeroplane observation. The German artillery was definitely mastered on the Somme by this means, and hostile counter-battery work practically ceased. Co-operation between the air and the guns was not, even in 1916, by any means perfect. It was not till the end of 1917 that the regulations existing at present had been fully worked out. We are nowadays in a very rudimentary state as regards counter-battery work in open warfare. The lesson of the Somme, in this respect, is that advances can only be made by the training of the air and the guns being made in the closest co-operation, and with actual shell.

ii. Concentrations for destruction.
These concentrations were started in order to endeavour to destroy the enemy, when the observation from the air was either climatically impossible or machines were not available.

Methods were continually improved until this form of attack became very formidable. On one occasion in 1917 a village, filled with heavily concreted batteries, which all other methods had failed to subdue, was completely evacuated by the hostile artillery after a super-concentration.

Practically all the guns of two Corps on a battle front, bombarded the village for an hour. The concentrated concussions completely destroyed it.

iii. Neutralisation.
This had commenced very early in the war. The improved methods of artillery intelligence now began to make battle neutralisation a possibility. The enemy's barrage or other dangerous batteries were spotted and heavily attacked at zero hour.

The protection of the infantry assembly also began to be a counter battery possibility on account of the improved intelligence at our disposal. The General Officer commanding Royal Artillery Corps thus began to co-ordinate the counter battery work with the operations of the infantry, and was able to ensure that its activities were directed at the same objective as the rest of the forces of the Corps.

The harassing fire carried out during the 7 days bombardment at the commencement of the Somme had been very successful. Two British soldiers, captured during this period, remained in a front line

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dug-out until the day of attack, as it was quite impossible to evacuate either them or their information.

During the battle, harassing fire was further developed, with the result that artillery and the intelligence branch of the staff came into very close touch. Special harassing fire maps, showing the localities where the best results might be expected from intelligent fire of this nature, were first printed at this period.

The state of the Somme battlefield when the enemy evacuated it the following Spring conclusively proved the value of this form of fire, when there is ammunition to spare beyond that required for actual attacks. It was therefore continued and improved throughout 1917 and '18. It was largely this form of fire, in 1918, which made the salient around Merville such a costly operation to the enemy.

Long range gun fire was conducted without any definite battle policy at this period. The guns were used chiefly for harassing fire. On July the 1st, von Stein's Headquarters (XIV Corps) at Bapaume were hit by 12-inch shells and Corps Headquarters moved that day to Le Transloy. The move was discovered from a captured order and a long range gun caused another move. The Corps then retired beyond the range of our guns.

Considerable disorganisation was caused by this success. Reinforcements, moving up to the battle, received no maps and no information, so that the confusion was considerable.

Nevertheless the long range gun shelling of headquarters is of very doubtful value. It is extremely difficult to select the right moment for the shelling, and even then it is very fortunate if the shelling is sufficiently accurate to cause a move such as that of the XIV German Corps.

These guns were not really brought into co-operation with the other arms till the following year.

All the above had of course great effect on infantry training and as usual, we went to extremes. The infantry learnt to follow the barrage with the greatest dash and often got in with a few or no casualties. The bomb then practically replaced the rifle, so that no exploitation took place beyond the range of the guns. This loss of musketry was to have a very serious effect later on. It was partly due no doubt to the losses we had suffered at Loos and on July 1st, which had reduced many battalions to a very low ebb as regards trained subaltern officers.

By the end of 1916 the following state of development had been reached :—

i. Before plans for a battle could be made, it was essential to know the minimum amount of artillery which would be available. This limited the scope of the operations. The artillery then formed the frame-work on which the proposed operations were built up. Simplicity in arrangement, observation facilities and telephonic communication was then the main point to be sought for. Enfilade fire in mass is thus unsuitable for major operations.

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ii. The destruction of the hostile communications is one of the chief objectives to be sought after in any bombardment.

iii. Where German wire existed, no hurricane bombardment had been deemed sufficient preparation for an attack.

iv. The necessity for a centralised artillery command was fully realised in order to :—

(a) Control all the fire so that the element of surprise, so essential at zero, could be brought about by the action of the artillery.

(b) To co-ordinate all the artillery fire at zero so as to obtain the maximum effect in the attack from the infantry, field artillery and heavy artillery and to direct the counter battery artillery so as to assist the operations to the utmost.

(c) To lay down a definite artillery policy between battles so as to cause the enemy the maximum number of casualties both by harassing fire and counter battery work.

v. The chief danger spot in any attack is the infantry forming up place. If surprise is achieved at zero, the hostile guns need not be feared till either a halt is made on an intermediate objective, or the final objective is reached.

vi. Zero hour is the hour at which the artillery barrage opens.

vii. The artillery undertook the duty of driving off the enemy's counter attack within its range by means of the protective barrage, and to a limited extent during this year, by means of calls from the air.

viii. The fact that the artillery provided the fire and the infantry the movement was almost a principle at the end of the Somme.

ix. The number of shell you could put into the front line was as much a tactical matter of importance as the number of infantry. The fact of whether you could have a battle at all and always when you could have it, depended on ammunition supply. This will constantly recur, and staffs must be prepared to make estimates both as regards the total amounts required for a battle, and for the time it takes to collect it at the guns. With practice these estimates can be made to very close figures.

x. It was apparent that ammunition expenditure always tended to increase—this went on through the whole war and during the mobile operations of 1918 was greatest of all.

xi. It was also apparent that no roads could stand the ammunition transport and that light railways must largely replace roads in 1917.

xii. Ordnance workshops—both as regards their output and location became a tactical matter, as it had a direct bearing on the efficiency of the barrage. Out-put had to be regulated so that the shops were as empty as possible on battle days,

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and time had therefore to be saved by their location as near to the fighting as it was possible to put them.

xiii. Gas shell was beginning to be used, but the quantities available were not sufficient for any definite results to be achieved.

xiv. Lack of information in battle still remained one of the greatest difficulties of the artillery. Liaison between the infantry and the artillery was still one sided; more experience in battle was still required to make it a mutual affair.

xv. Finally the German machine gun had appeared as our greatest enemy; and our minds were firmly fixed on it as our chief tactical objective.

The enemy appreciated the situation as follows during the Winter 1916-1917.

i. The effect of the British artillery fire had been overwhelming both as regards moral and in actual casualties. The tone of the people in Germany had been changed from the great optimism after Verdun to deep depression.

ii. Their method of disputing each trench with strong garrisons had caused them great losses both in killed and prisoners.

iii. There was little hope of competing with us in the supply of artillery material or of personnel to man the batteries if made, on account of the claims made by their Eastern and Western fronts.

iv. The one bright spot was the German machine gun.

v. Tactics must therefore be amended so as to nullify the effect of our artillery, both as regards the German infantry, machine guns and artillery; and to tempt our infantry beyond the support of our guns so as to place them on an equality with the German infantry.

This was of course unknown to us at the time and we had become stereotyped in our methods—the Germans had never changed their style all through the war and were considered to be very conservative. We had apparently found a method of war, which if correctly applied met with success. We therefore stuck to it and in fact forgot the old Chinese maxim "Once a strategem has been successful never repeat it."

(To be concluded).

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THE ARTILLERY IN INDIA.

BY MAJOR C. A. L. BROWNLOW, D.S.O., R.F.A.

FORCE of circumstances necessitates nearly half the Royal Regiment of Artillery serving in India and this rift causes a mutual ignorance between the gunner in England and his brother in India. The post bellum organisation of the Army in India, based on experience dearly bought in the great war, on new political conditions and altered military requirements, has affected materially the artillery in India; besides which changed circumstances of life have made present service very different to that of pre-war days. It may be of interest, then to give a rough survey of the artillery in India at the present time; and though what follows will be mere commonplace to gunners out here yet to those at home there may be some meat upon the bone.

Organisation of the Army in India.

The organisation of the artillery cannot be appreciated until the organisation of the Army in India itself is understood; and so this we will first describe.

After the war to quote an official pronouncement "the military centre of gravity shifted from west to east"; and India after the Armistice still found dark clouds lowering on her horizon. Shaken by internal disturbances, worried by tribal risings on the North West Frontier and an openly hostile Afghanistan, anxious about the Bolshevik forces in Persia, India needed an efficient army; but there was no army to hand; true she mustered on her rolls more men than ever before in her history but they were either committed overseas or in process of movement and disbandment. The British garrison were Territorials clamouring for return to England. The whole army was in a state of flux, and improvisation took the place of a stable organisation. It was patent to all that a definite policy must be decided upon. In 1919 the Esher Committee was appointed to enquire into the organisation and administration of the army in India and a year later issued their report. Great changes took place among commanders and staff. Sir Claude Jacob became C. of S. and towards the close of 1920 Lord Rawlinson succeeded Sir Charles Monro as Commander-in-Chief. A general readjustment of units took place; by the end of 1920 the reshuffle had been nearly completed and India furnished with the troops of her post war garrison. Departmental and other changes occurred, especially in the organisation of Army Headquarters. It was not, however, until the end of 1920 that the new general organisation came into effect.

The organisation of the Army in India, on the outbreak of war, was materially that instituted by Lord Kitchener, viz: nine divisional

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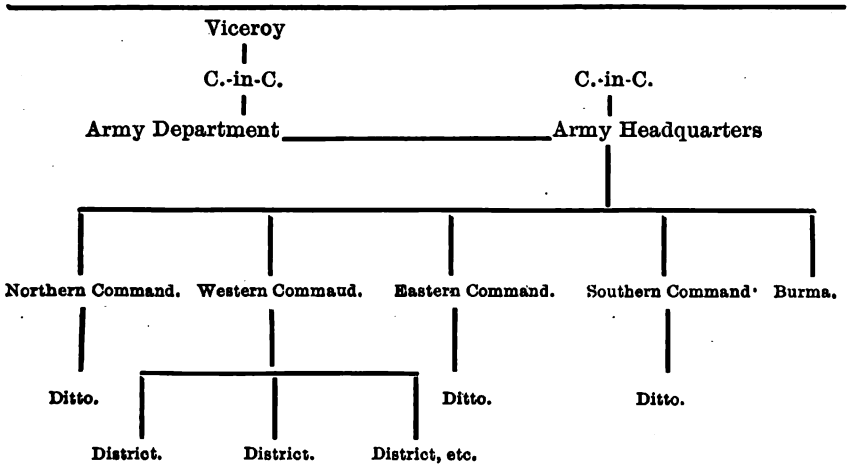
areas each producing a division on mobilization, divided into a northern and southern army, the whole controlled by Headquarters at Simla. The acid test of war found this system unsatisfactory for many reasons—for instance confusion arose over a war division and the divisional area from which it came; again a war division was far too weak in artillery.

The present organisation divides India into four Commands each of which is subdivided into a number of Districts. A District roughly corresponds to the old divisional area. Whereas, under the old scheme divisions dealt direct with Simla, and the headquarters of an army was in the nature of a training inspectorate; under the present system authority is decentralized to Commands through whom Districts must correspond. Much administrative work formerly done by A.H.Q. is now done by Command Headquarters. The following diagram illustrates this organisation.

TABLE I.



The above diagram (Table I.) shows the Army Department which is part of the Secretariat of the Government of India and is the bureaucratic instrument by which the Army is controlled. The C.-in-C. combines the function of C.-in-C. with that of head of the Army Department whereby he is member extraordinary of the Executive Council.

This peace organisation is designed to produce in war five cavalry brigades, four divisions and a covering force along the North West Frontier. The remaining units are used for purposes of internal security.

Organisation of the Artillery.

Staff. The old appointment of Inspector of Artillery has been abolished and its place taken by a 'technical advisor' to the General

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Staff at A.H.Q. who is a Major General, Royal Artillery, commonly known as the M.G.R.A. He has three staff officers ranking as G.S.O.1, G.S.O.2, G.S.O.3 respectively. Under the M.G.R.A. as technical advisors to each Command are four Colonels Commandant Royal Artillery, each having a staff officer R.A. who ranks as a G.S.O.2.

This forms the whole R.A. staff in India. The old C.R.A. and B.M.R.A. of a Division have been abolished. The C.C.R.A. of a Command is, therefore, called upon to perform many of the functions of the old C.R.A. In the event of war the staffs of divisions would have to be found from units.

Unit Organisation.

Better than words can describe, (Table II.) explains the relationship of the various branches of the artillery in India. It should be noted that the Indian artillery, although officered by the Royal Artillery is a separate service, being an integral part of the Indian Army.

R.H.A.

There are five batteries of R.H.A. to each of which is affiliated an ammunition column, bearing the same designation, thus K battery has K ammunition column. The brigade organisation has fallen out and, the R.H.A. is now administered by one Lt.-Colonel.

A battery consists of British officers 6, British other ranks 175, Indian officers 1, Indian other ranks 72, horses 207, and six 13-prs.

R.F.A.

There are ten brigades. Brigades are of four batteries, some consisting of two 18-pr. and two 4·5-how. and some of three 18-pr. and and one 4·5-how. Certain brigades of the covering force have brigade ammunition columns.

A battery consists of British officers 6, British other ranks 163, Indian officers 1, Indian other ranks 75, horses 168, and six guns or howitzers.

Coast Defence.

Coast defence companies call for no remark, except to state that fortress armament is mostly in a state of "soap and oil."

Medium Artillery.

There are nine batteries in India organised into two brigades and an independent battery. This organisation is in a state of transition. Most of the batteries are tractor drawn but all have not yet received their tractors. They are armed with 6-in. hows. or 60-prs.

A horse drawn battery consists of British officers 6, British other ranks 135, Indian officers 2, Indian other ranks 101, horses 136.

A tractor drawn battery consists of British officers 6, British other ranks 134, Indian officers nil, Indian other ranks 18.

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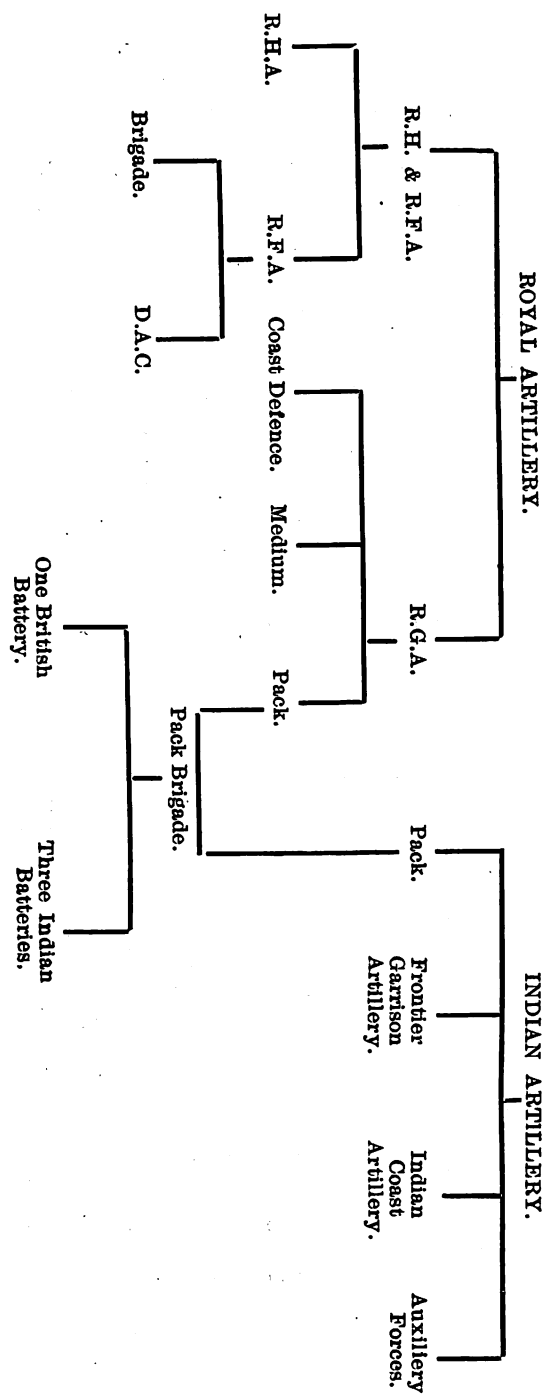
TABLE II.

ARTILLERY IN INDIA.



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Pack Artillery.

There are five brigades of pack artillery, each consisting of four batteries, one British and three Indian. The eventual armament of a brigade will be three batteries of 3·7 hows. and one battery of 2·75 guns when sufficient 3·7 equipments are available.

A British battery consists of British officers 5, British other ranks 118, Indian officers 2, Indian other ranks 172, animals 179, and four 3·7 hows.

An Indian battery consists of British officers 4, British other ranks nil, Indian officers 4, Indian other ranks 281, animals 180, and four 2·75 guns or 3·7 hows.

Divisional ammunition columns.

There are four of these, one to each division. Before the war an Indian D.A.C. was the command of a Captain, but now is that of a Lt.-Colonel. The field artillery sections only are extant in peace. The Pack and S.A.A. sections are formed on mobilisation.

It is a large unit consisting, when mobilised, of British officers 10, British other ranks 86, Indian officers 9, Indian other ranks 676, and animals 1,060.

Further reduction of the peace establishments of the D.A.C's is under consideration.

Instructional and other Establishments.

There is an artillery school at Quetta and an equitation school at Ambala. At Deesa there is a Training Centre for British and Indian ranks of R.H. and R.F.A. and at Lucknow a Pack Artillery Training Centre.

War Organisation.

Batteries of R.H.A., R.F.A. and R.G.A. medium which are six guns or four in peace go to war as four-gun or How. batteries. The third section is left behind for purposes of internal security and training. Pack batteries are four guns or hows. both in peace and war. To each division there are three brigades of artillery which in some cases are all R.F.A. and, in some, two brigades of R.F.A. and one of Pack Artillery.

Batteries of R.H.A. will act independently one battery working with each cavalry brigade.

Medium artillery become army troops and their brigade organisation will probably cease.

We have already mentioned the fact that C.R.A's. and their staffs have to be found on mobilization.

The above are peace establishments and are liable to change for they are, at least as regards Indian ranks, experimental.

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GENERAL REMARKS.

Indian Ranks and Syces.

The main change that has taken place in the Royal Artillery in in India since the Great War is due to the large number of Indian ranks now included in the establishment and to the practical abolition of syces.

In a pre-war battery there were about a dozen Indian ranks under a Naik; now a third of a battery consists of Indian ranks under an Indian Officer. The reason for this introduction was twofold; first to do away with syces who were not wanted in War and second to provide a reserve of Indian ranks; over both these reasons dimly fell the shadow of the Indianisation of the Royal Artillery in India. Resultant on this, syces were abolished except for a few who were retained as a special concession for menial work in the lines.

These measures resulted in many difficulties, which it is not necessary here to enumerate, but any battery commander in India can expatiate upon them at length. The present establishment, as we have already stated, is not definitely fixed but is in the experimental stage and it is probable that a partial re-introduction of syces will take place shortly.

The large number of Indian Soldiers now in a battery has made it a practical necessity for all officers to speak the language. The same cause has led to the time honoured section organisation proving unsatisfactory and trials are being made to reach an organisation whereby Indian and British ranks are kept apart.

Cost of Living.

Before the war India held out many advantages to the poor man. Pay was better than in England, the cost of living cheaper and speaking generally India offered, in many ways, better value for money. Now matters have changed. The English rates of pay have risen more than Indian rates and in India there are no marriage allowances. The high cost of passages stops down summer leave in England. The double establishment which married officers are forced to maintain in India means heavy additional expenditure which is increased if he has children at home. Bungalows are difficult to get, are in bad repair, rents have gone up and tend to further rises. Goods from England owing to cost of transit and to new import duties are most expensive. Servants wages have risen and this becomes a considerable item when one keeps the number of servants which one is forced to do in India.

However, as an off set to this it should be noted the general cost of food which has more than doubled in England has not risen more than fifty per cent in India.

Sport.

The lure of sport which India always has offered still remains as great an attraction as ever. Polo flourishes everywhere; racing is on a higher level than before the war; pig-sticking is, still, the incomparable

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of sports. The fisherman can generally find stream or river to cast his fly and the keen shikari can get his small and big game shooting; on the far away mountains of Baltistan, bare, wind swept and grand, or in the dark and solemn depths of a Deccan jungle India offers you a gift from nature that England can never give.

"A Show".

Whatever the responsibilities, the worries and difficulties of a battery Commander in India, he does get a real live "Show" to run. He is a Battery Commander with a battery, fully armed, fully manned, fully horsed at his command with limitless ground to manœuvre over. His battery is a battery and not a nucleus of recruits and a few horses to be occasionally drilled in a back yard.

Politics.

It may not be out of place here to touch very briefly on the political changes which have occurred since the passing of the India Act of 1919, because these have affected in no small degree the Army in India. An Army is a political organism and its nature depends on the political constitution of which it is the instrument. Before the Montagu—Chelmsford Reforms the Government of India was absolute and autocratic, responsible only to the Parliament at Westminster and in consequence the army was uninfluenced by Indian public opinion.

By the India Act of 1919 Provisional and Imperial Legislatures are elected bodies. In the Provinces there now are Indian Ministers responsible to the Legislature; and though this is not the case in the Imperial Government yet here also a vital change has taken place. The Government which formerly had sufficient nominees in council to ensure a majority whatever happened is now in a minority.

Though the army is technically a reserved subject yet in spite of this the experience of the past year has proved that the Indian Opposition by passing resolutions and by refusing to vote supplies can seriously affect military policy.

As time goes on, this power of the Indian Parliament is bound to increase and to affect the army more and more. To what it will lead no man can say, but we can say that the future is pregnant with great events.

It is hoped that this article with its somewhat random remarks may throw some light on certain phases of service in India.

Those who serve in India have ever raised their voice in lamentation of their lot and to-day the cry is even louder than aforetime; but when at last the day comes to leave her shores and, watching the lights of Bombay sinking over the stern, they give thanks for present mercies, in some strange way, with their joy mingles a deep regret that they and India are parting for ever.

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ARTILLERY TRANSPORT.

BY CAPTAIN C. L. GRANSDEN, I.O.M.

THE memoirs of a Crimean veteran published about a decade ago, contained a comparison between the French and British transport; to the detriment of the latter.

The opening of the Great War saw British animal transport second to none, but our general transport organisation was not so far in advance of Crimean conditions as the age warranted.

The sudden and wholesale utilization of civilian motor transport however marked the beginning of a process of balancing animal and mechanical transport necessitated by the employment of all modern resources in warfare. This process is even now necessarily in an intermediate stage; for the lessons of the late campaign have yet to be digested and applied; whilst many of the factors, the resolution of which must precede this application are themselves changing with the times.

It may be justly claimed that transport is a key factor in the selection of artillery design. This is historical, commencing perhaps with the Officer of another generation, who declared that; "The Royal Horse Artillery would make the finest cavalry in the world if it were'nt for those—guns."

The limits within which this factor varied however were very limited until the age of mechanical transport, but its sudden expansion in the Great War found all the combatants comparatively unprepared to take advantage to the full of this powerful aid.

In our own case, heavy equipments designed during 1914—16, plainly showed an attempt to obtain the highest possible ballistic effect with a minimum of draught weight. The threefold harmonizing of maximum ballistic effect, draught weight, and tractive power would have saved much loss and vexation from this faulty design.

Our principal allies suffered less in this respect because they probably necessarily attempted much less.

The Germans cannot intrinsically claim to have achieved much more; although both German and Austrian Engineers produced early the very largest nature of siege ordnance in mobile form, this was only a specialized effort.

The pitch of perfection to which our horse transport has been brought, at least earns for it full consideration as to fitness for retention as a form of specialised transport, at any rate for a considerable time to come.

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Mechanical motors have the advantage over horse draught in :—

(1). Greater concentration of power per unit of weight.
(2). Greater continuity of effort.
(3). Lesser ancillary wastage.

They have the disadvantages of :—

(1). Decreased adaptability.
(2). Lesser reliability.

Generally therefore the disadvantages of mechanical motors tend to disappear in collective action.

The opposite effect occurs in mobile warfare and animal draught becomes correspondingly more important—well illustrated in the offensive phases in the late War by both sides—we were well served and our opponents badly.

Apart from the use of animal draught for artillery there are good grounds for using it as a branch of generalised transport.

The effective motorization of field equipments, will lead eventually to such radical changes in design as will entirely differentiate these types from their horse drawn counterparts. If the tractor motor be incorporated with a carriage, it will not be a far cry to the gun carrying tank.

The germ of the idea of specialized transport existed during the War.

The French Artillery moved 75's over long distance by lorry.

In our 6-inch Mark VII Batteries, the establishment of tractors provided for three petrol and one steam, the latter being better for long road journeys. This was about as far as the matter went. No attempt was made to adapt our medium heavy artillery for long journeys by road. Consequently it suffered badly in materiél efficiency.

Unless a radical change in our tactical formation is to take place (and such consideration is outside the scope of this paper), artillery equipment attached to these formations should be :—

(1). Reliable in upkeep and simple in maintenance.
(2). Self supporting to a maximum degree.
(3). Adaptable and mobile.

Our pre-war 13-pounder, 18-pounder, 4·5-inch howitzer and 60-pounder generally fulfilled these conditions. Where failures occured these were due to the fact that warfare on a large scale had not been legislated for, as the general assumption was that the Divisional Artillery would bear the brunt of general action supported by some heavy artillery. The weight and ballistics of the 13-pounder made it very suitable for horse draught in all lands. It is perhaps unfortunate that it seems doomed to disappear.

In 1917—1918, horsemasters from other arms were selected to assist in looking after Artillery horses. This was not so likely to interfere with the free action of an Artillery Commander to anything

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like the extent which the placing of the whole of the mechanical transport in the hands of another branch might have done.

The manning of Artillery motor transport by any but artillerymen, could only be justified by fortuitous circumstances, and these no longer exist.

In motorized field artillery the motor tractors will probably remain near or even at the guns, and this will necessitate the transport command being in the hands of gunner officers, and the skilled mechanics charged with the maintenance of the condition of ordnance and carriage will be the most suitable men to maintain the motor tractors also.

The same applies to the tank, where the same crew, fight, move, and maintain (light repairs) the complete equipment.

In a general scheme, ammunition transport will fall into its natural place and will keep pace with other departments. Failures during the Great War were due to the wholesale improvisation there adopted. In conclusion it is submitted that the Royal Regiment of Artillery, incorporating "Artillery Engineers" should carry out all fighting, maintaining, and transport duties connected with artillery.

The general policy for the future should be, subject to the limitations of economy, (which should not interfere with the skeleton framework) to make mobile artillery truly mobile, and the general artillery reserve as massive as possible.

A table is appended showing types of artillery transport :—

Specialized Transport. Divisional Formations.	Motorized Light Artillery (Field or A.A. at will). Cross country rapid. Motorized Light Artillery (Field or A.A. at will). Road rapid. Horse drawn Light Field Guns. Horse drawn Field Howitzers. Horse drawn Heavy Guns.
Specialized Artillery. Higher Formations.	Motorized Heavy A.A. Artillery. Cross country. Motorized Heavy Field Guns. Motorized Field Howitzers. Motorized Heavy Guns. Motorized Heavy Howitzers. Motorized Siege Mountings.
Subject to generalized transport Higher formations.	Railway Mountings.
Generalized transport. "Artillery Engineers" to act as Liaison Officers.	Horse Parks. Lorry Parks. Carrier "Tank" Parks. Decauville Tracks. Railway Transportation. Aerial Transportation.

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THE GERMAN ANTI-AIRCRAFT IN THE GREAT WAR.

A Précis of an article in the Militär Wochenblatt of February 12th, 1921, entitled "Flak" (Flugzeug-abwehr-kanone) by Hauptmann Seydel, late O.C. the 20th Flakgruppe.

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

The German Army took the field in August 1914 with 18 anti-aircraft guns, 6 on motor lorries, 8 anti-balloon guns on mobile mountings, and 4 guns on pivot mountings. It was soon discovered that this was quite insufficient and every makeshift was adopted to supplement them. Thus, at the end of the war, 25 different varieties of gun were in use, including adapted French, English, Belgian, Russian, and old German guns. This increased the difficulties of training. The manufacture of new types of ordnance during the war was especially difficult in the case of A.A. guns, for which no basic principles had been arrived at and the ballistic and tactical requirements of which were not understood.

There was a similar confusion of types of range-tables, ranging and sighting apparatus, and other accessories. Fresh models were always being produced.

The high demands made on anti-aircraft personnel were insufficiently taken into account when reinforcements were being selected. The strain of searching the heavens for hours, in strong sunlight, concentrated on the slightest noise, is not realised by those who have not done it. There were no days of rest. The difficulty of distinguishing friend from foe in the air was increased at night, and the decision as to opening fire had to be taken at once or it was too late.

The strain on the signal detachment is shown by the fact that a telephone office in the writer's group had to put through an average of 500—600 calls a day. The personnel allowed for this was meagre.

Not only were the A.A. positions specially attended to before attacks, but on other parts of the front they were subjected to concentrated fire and frequently compelled to change their positions.

The achievements of the A.A. cannot be measured solely by the machines brought down, but also by the degree in which they interfered with hostile aerial work and damaged hostile machines. At the beginning of the war, enemy observing and fighting machines used to fly over the lines at about 800 metres; they were soon driven by the A.A. to over 3,000 and even 4,000 metres. The number of machines definitely shot down was relatively high and continually increased in the last months of the war. In May, 1918, 72 were shot down, in June, 92, in July, 69, in August, 62, in September, 125.

The light anti-aircraft gun further distinguished itself in anti-tank work, for which its mobility and rate of fire made it especially adapted.

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TRANSLATIONS OF GERMAN DOCUMENTS ON ARTILLERY TRAINING, ETC.

AERONAUTICAL ARTILLERY OBSERVERS.

(Summary.)

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

IN the Militär Wochenblatt No. 51 of 1921, Colonel Frhr. von Weitershausen has an article entitled "Der Artillerieflieger". He complains that shortage of personnel and aeroplanes prevented the Artillery from getting their own flying detachments during the war, that the flying detachments and divisions were changed so often that good co-operation was difficult, and that airmen did not like trying to observe for small calibres.

The writer then proceeds to consider the requirements of the section of the aviation service, which is to co-operate with the artillery.

Aeroplane and pilot must, by dexterity in flying at all altitudes, and by rapid climbing and diving powers, make the observer's many-sided task possible. The observer must be thoroughly trained in all strategic and tactical flights in order to be able to correctly appreciate any situation. He must not only be able to register a battery, but he must at all times be able to give the Artillery commander a clear report on his own and the hostile fire, in order to give this commander a valuable indication for his decisions. Especially in big battles does the Artillery commander need the artillery observer to discover unbeaten zones, and enable him to regulate his fire accordingly. In order to do all this, the artillery airman must be capable of observing the fire of big masses of artillery and determine where it is falling. He must be a good photographer, who knows exactly from what altitude his camera will take the best pictures. As an artillery commander, I do not want pictures of large areas, but I must be able to see details in photographs, in order to be able to pinpoint hostile battery positions and if necessary to correct my map by the photographs.

In actual shooting, the observer must be trained as a battery commander in action ,and further not with one calibre only, but with as many as possible. He must know the peculiarities of the various types of gun and their Service. Only so can he follow a shoot under the difficult conditions of war and direct it with success. Shooting is an art which cannot be learnt entirely out of books.

Only long practice enables the battery commander to switch his fire about as he wishes, to concentrate it on a certain spot, or distribute it, and that in big masses, when it is desirable to have big fire-formations. When the airman has once done all that himself, he can much more easily put himself in sympathetic touch with the battery.

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The Artillery airman must be able to think as a gunner. From this it follows directly that the flying detachment must be just as much under the artillery commander as his artillery regiments, battalions, and batteries. To the artillery commander must also be left the criticism of the artillery observer. Thus alone is that close co-operation, which is really effective, possible. The artillery flying detachment must only be under the General Inspection of Air Forces so far as the technical supervision of material and the flying knowledge of the pilots is concerned. Only if the Artillery flying detachment becomes an integral part of the division to which it belongs, can it do its best.

The artillery airman must be thoroughly acquainted with all the characteristics in action of the individual batteries of his division. It is therefore not sufficient that, before the aerial shoot, the observer dashes in a car to the B.C. to discuss the matter shortly with him. He must, on the contrary, repeatedly be present at the battery during shoots, in order to see how the personnel works, how the B.C. conducts a shoot, and so on. In my opinion, squaring the map assists the artillery observer to find and place the bursts. After an aerial shoot during a shoot during a quiet period, a discussion of it must be held in order that mistakes may be cleared up an further simplifications arranged. In this, as in everything, theory and practice must go hand in hand.

During quiet periods, the artillery flying detachment must be used with the counter-battery staff to register the chief points for the extensive harassing fire of the batteries. Direct observation is impossible for this work, which is often designed to harass the rearward portions of the hostile trench system. An exact registration of batteries on the target is, however, essential, especially for gas-shoots. A gas-shoot is only effective when the gas-cloud lies on the target, not several hundred metres to the flank or front. Every metre is indeed of importance. In this connection, much that was nonsensical was done with harassing fire during the war; but it was quite excusable, since gas warfare was a war invention and the very beneficial instructions of the course at the Army Gas School could only gradually become common property in the Army. Now for harassing fire, small calibres are of first importance. Hence the artillery airman must be perfectly expert and sure in registering these calibres.

In big battles, the artillery airman must be used to locate the fall of hostile and friendly fire. By clear reports he can greatly assist the artillery command.

From all this it is evident that the work of an artillery flying detachment in a division is so great that it can have no spare time for other tasks. Hence the work of divisional infantry machines must certainly be given to a separate detachment. The two serve entirely different objects and do not belong to one detachment.

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SOME REFLECTIONS ON THE CAVALRY CAMPAIGN IN PALESTINE.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 7th March, 1922.

BY COLONEL G. A. WEIR, C.M.G., D.S.O.,
Colonel Commandant 3rd Cavalry Brigade.

Lt.-Genl. Sir P. W. Chetwode Bart, K.C.B., K.C.M.G., D.S.O.,
Deputy Chief of the Imperial General Staff in the Chair.

THE CHAIRMAN: Ladies and gentlemen in introducing to you this evening Colonel Commandant Weir, I would like to say that I think there are very few people who can speak with greater experience, if not greater authority, than he can about the mounted arm. He has served with the mounted arm in South Africa, and has been in all parts of the world with it in peace; he knows all about the peace training of it, and in the War he not only commanded a cavalry brigade but he also commanded an infantry brigade and, therefore, he will not talk to you from an entirely prejudiced cavalry point of view. He has full sympathy with the infantry as well as with his own arm. I think he feels to-night that perhaps he has got a more sympathetic audience than he would have elsewhere because he knows so many of you have worn the jacket and know considerably more about our difficulties—the difficulties of the mounted arm—in war than the other arms do.

I will now ask him to commence his lecture. (Loud applause).

LADIES AND GENTLEMEN: In order to enable you to realise the conditions under which this campaign took place I will begin by showing you a series of photographs illustrating the various types of country met with.

This is a map showing the main physical features, and this black line marks approximately the positions of the opposing forces on September 18th 1918, immediately before the great attack.

The principle features are the Hills of Moab, the Jordan Valley, the Judean Hills, the foot-hills the maritine plane and the sand-dunes; this series of views gives you a very fair idea of the difficulties of the task which presented itself to Lord Allenby.

He has available 12,000 sabres, 57,000 rifles and 540 guns, whilst the enemy's fighting strength was estimated at 4,000 sabres, 32,000

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rifles and 400 guns, giving him a preponderence of 3 to 1 in cavalry, 7 to 4 in infantry and 11 to 8 in guns. His infantry superiority was considerable, but no greater than that of the Allies over the Germans in France during the greater part of 1916-1917; it was to his cavalry that he must look for decisive results.

He states in his despatch that his great superiority in cavalry was the determining factor of his selection of his point of attack, and although he was obliged to weaken himself elsewhere he was apparently determined that his cavalry should have a clear path made for them through the enemy's lines.

Here is a map showing his concentration for the attack, and you will notice that while he concentrated 35,000 infantry and 383 guns on a front of about 15 miles held by the enemy with a force of 8,000 infantry and 130 guns, he left only 22,000 infantry and 157 guns to hold the remaining 45 miles of front.

There was no reserve, every available man was pushed into the front line, even the corps cavalry, pioneer battalions and details from reinforcement camps being formed into Watsons Force and given a part of the front under the Twentieth Corps.

On this 15 mile front you will see that the salients only were attacked, so that the greatest possible depth could be given the infantry.

There was no preliminary bombardment, but every gun including the horse artillery and the mountain artillery took part in the barrage which came down on the enemy's front line trenches at zero hour, the time at which the infantry advanced from their position of deployment.

The creeping barrage was dispensed with and the guns lifted from one trench line to the next, in accordance with a time table arranged by divisions. In the 7th Indian Division lifts were timed to allow the infantry to advance at the rate of 100 yards per minute.

The cavalry, 3 divisions, were hidden in these orange groves.

I should now like to draw your attention to the tasks set to corps and the instructions issued.

The R.A.F. had already established air superiority, during the period of concentration, and the chief task set was to attack all the enemy H.Q. in the hope of destroying his communications, paying particular attention to hostile aerodromes so as to prevent his planes leaving the ground until the arrival of the cavalry.

The task of the 21st Corps (5 divisions, one mounted brigade and the French detachment) was to break through the enemy's defences between El Mughier and the sea; as soon as the line Et Tireh—Nahr Falik had been captured it was to wheel to its right end advancing eastward to drive the enemy from the line Deir Sheraf—Tul Keram, and be prepared to pursue the enemy in the direction of Jenin.

The 20th Corps was to attack astride the Nablus road, and to be in a position to advance towards the high ground north and north east of Nablus on the evening of the day on which the 21st Corps made its attack.

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Chaytors force was to be held in readiness to attack east of the Jordan on the receipt of orders.

Task of the Desert Mounted Corps.—As soon as the crossings over the Nahr Falik and the marshes to the east have been cleared of the enemy by the advance of the 21st Corps, the Desert Mounted Corps passing round the left of the 21st Corps will advance to Afule and Beisan to cut the enemy's railway communications, and to block his retreat in a north and north east direction.

First objective the line Kakon—Tel Edh Dhrur.

To push on with the utmost speed to the Afule area.

Every effort must be made to prevent the escape of Turkish rolling stock by cutting the railway lines from Jenin and Haifa to Afule at the earliest possible moment.

Retaining sufficient troops in the Afule, Jenin, Lejjun area to close the Turkish lines of retreat to the north and north west, to push on to close the roads which converge on Beisan from the Jordan valley and Nablus.

The special instructions issued to the Desert Mounted Corps lay stress on the following points.

(a). On no account to allow troops to be drawn into the infantry fight south of the Nahr Falik.

(b). Not to be diverted from main object by the presence of hostile troops in the Tul Keram—Et Tireh area.

(c). To cross the line of the Nahr Falik at the earliest possible moment, but advance not to interfere with the infantry attack or mask the fire of the corps artillery.

(d). If the enemy retreat towards Haifa only sufficient troops to be detached to watch them, as large a force as possible to be placed across the enemy's communications about Afule and Beisan.

(e). The action of troops to be characterised by the greatest vigour and rapidity.

(f). From Afule a detachment to be sent to seize the bridges over the Jordan at Jisr Mejamie.

At a conference held at G.H.Q. on 11.9.18 the G.O.C. 21st Corps asked that the Cavalry Corps should not pass north or east of the general line occupied by his artillery waggons until the artillery moved forward. The Commander-in-Chief said, that the G.O.C. Desert Mounted Corps was responsible that the cavalry movements in no way hindered the progress of the 21st Corps attack, and that he would lay down no other restrictions.

I have given you this summary because, apart from the fact that the instructions to the cavalry appear to me to be a model of what such orders should be, there are three points of special interest. Firstly, the whole strategic plan was based on placing a mass of cavalry across the enemy's lines of communications and, as is shown in the C.-in-Cs. decision at the conference, all other considerations were subordinated to the achievement of this main objective.

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Secondly, the advantage gained by cutting these communications so far back. The line Afule—Beisan lay 40 to 45 miles behind the enemy's front line, so that his infantry, pressed back in front and threatened on the flank, had at least two twenty mile marches to make before they came in contact with our cavalry. Our presence on that line came as a complete surprise to them, and so great was the moral effect on men, who after three or four days continuous fighting and marching thought they were at last about to reach safety, that they surrendered after slight resistance.

Thirdly, the stress laid on the avoidance of side issues and the utilising of every available man for the main task.

The story of what happened is well known. Thanks to the depth given to the infantry attack and the concentration of artillery fire, the enemy's line was pierced to a depth of three miles within two hours of the opening of the first gun; the twenty-first Corps wheeled to its right and began its advance towards the foot-hills, and the cavalry passed through the gap.

Within thirty-six hours they were on the line Afule—Beisan, having overrun all the reserves that the Turks tried to hurry to the scene of action. One brigade reached Nazareth 50 miles in 28 hours and the 4th Cavalry Division Beisan (80 miles) in 36 hours. Within four days the whole of the Turkish Seventh and Eighth Armies had been destroyed, and Haifa and Acre had been occupied. Within ten days Damascus had been captured, and the Turkish Fourth Army which had been east of the Jordan, together with the garrison of Amman had ceased to exist. With 36 days our cavalry had occupied Aleppo (300 miles as the crow flies from the point of departure) and were across the Bagdad railway, the only decent line of communication between the Turks in Mesopotamia and Constantinople.

Out of an estimated total of 105,000 Turkish troops south of Damascus 80,000 passed through our cages, and although it is impossible to estimate their loss in killed, the number must have been very great, for in addition to those who lost their lives in the initial attack, a large number were killed by our cavalry, aeroplanes, and machine guns, during the pursuit, and our Arab allies found in the destruction of stragglers and fugitives a task very much to their taste.

Practically the whole of the enemy's transport and artillery (360 guns) with some 800 machine guns fell into our hands.

It was perhaps the most complete victory which ever fell to the lot of a British commander.

I will now show a few photographs of the country over which the pursuit took place.

Afule occupied by the 4th and 5th Cavalry Divisions on the morning of the 20th.

Nazareth where the 13th Cavalry Brigade arrived also on the morning of the 20th; finally occupied on the 21st.

Shemak at the south end of the Sea of Galilee taken by the 3rd A.L.H. Brigade on the 25th after a stiff fight.

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The bridge of Benat Yakub over the Jordan north of the sea of Galilee where the Australian division met with severe opposition, and which they turned by swimming their horses across two miles south, and near Lake Hule.

The road between the Jordan and Damascus.

View of the Anti-Lebannons taken from Damascus.

The defile of Barada through the Anti-Lebannons on the road from Damascus to Beyrut, where the 3rd A.L.H. brigade cut off the remnants of the Turks fleeing from Damascus and destroyed them by machine gun fire.

A typical bit of country near Aleppo.

In visualising a pursuit "conducted at the highest pressure until the enemy is completely destroyed" (Cav. Training Sec. 7) or "continued by day and night without regard to the exhaustion of man and horses so long as the enemy's troops remain in the field" (F.S.R. 128) one is perhaps apt to imagine a mass of horsemen riding relentlessly after a disorganised rabble with no other objective than their immediate destruction. Any such conception would be completely at variance with the facts, if we judge by what took place in Palestine; this pursuit was rather of the nature of a combined operation, in which the Royal Navy, the Royal Air Force, and an infantry division took part.

On September 24th, the day following that on which the 15th Cavalry Brigade took Haifa, the advanced battalion of the 7th Indian Division arrived on lorries and took over from the cavalry, at the same time the Royal Navy cleared the harbour of mines and within 24 hours of the arrival of the first troops on land, had landed stores and opened up a new base, thus shortening the cavalry lines of communication with Damascus by about 100 miles.

Similar operations were carried out at Beyrut October 8th and Tripoli October 18th. The cavalry were always set a definite and limited task, and as soon as this was completed, a halt was called by the higher command until the rearward services were organised for the next bound.

There is one outstanding tactical lesson brought out by this campaign and that is that *where no physical obstacles (such as barbed wire) exists, cavalry can charge riflemen and machine guns in position with every prospect of success.*

On no less than 12 occasions during these operations did cavalry charge infantry and machine guns in position and in ten of these actions were entirely successful. Of the two which can be classed as unsuccessful, one was the mounted attack attempted at Irbid in which a squadron of the 2nd Lancers of the 10th Cavalry Brigade failed to reach the Turks who were esconced behind the walls of the village, and after suffering casualties were compelled to hold what ground they had gained until morning. The Turks retreated during the night.

The other partial failure was, the last action in the campaign at Haritan north of Aleppo, in which six squadrons of the 15th Cavalry Brigade attacked some two thousand Turks with many machine guns

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and two or three batteries of artillery in position. Though it was in itself a failure and the squadrons were compelled to rally to the rear, it had such a moral effect on the Turks that they withdrew eighteen miles during the following night, and took up a new position in which they remained until the armistice was declared.

I wish I had time to describe to you even a few of the ten completely successful charges against machine guns, but each would almost require a whole lecture to itself if the details which are so instructive are to be brought out. Some are described in Colonel Preston's book, and others in more detail in various articles which have appeared from time to time in the Cavalry Journal.

Perhaps, the most interesting were; Haifa where an almost impregnable position was taken, together with three batteries of artillery, some 1,300 prisoners and twelve machine guns. Remte where the Yeomanry after failing in a dismounted attack, mounted and in the charge took 100 prisoners and three machine guns. Abu Naj where the 29th Lancers charged thirty machine guns in action and took the lot with few casualties; and so on through the whole ten. You must read the details for yourselves.

There is one point of special interest and that is that in no single action did more than a brigade take part, and the greater number were fought by regiments and squadrons.

The use of a mass of cavalry does not imply the old conception of a cavalry mass concentrated in close formations, manœuvred as a single unit and capable of breaking down opposition by its own momentum, but rather a series of small mutually interdependent actions calling for great initiative and resource on the part of subordinate commanders, and co-ordinated by the higher command with a view to the attainment of a common objective.

I am absolutely convinced, that tactically success was entirely due to a bold use of the arme blanche combined where possible with covering fire of artillery and machine guns. The great increase of fire power in a cavalry unit, due to the introduction of Hotchkiss guns, set free a larger number of men for the mounted attack, and in the majority of cases covering fire from dismounted riflemen was unnecessary.

I think that the secret of the success of these mounted attacks against infantry and machine guns in the open lies in the fact that they were nearly always made in considerable depth, and always at wide intervals. Such a formation forms a difficult target, and the enemy's first feeling of surprise that their fire inflicts comparatively few casualties rapidly turns to panic, as he sees line after line of lancers galloping down on him; he feels "I may hit some of the first or second line but shall I ever be able to stop those in rear before they are on top of me."

These are however the views of a cavalry officer, so for the benefit of those who hold that the retention of the white weapon is due to the innate conservativism of the British cavalry, and that equal or

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greater success would attend mounted riflemen or machine gunners, I will read you an extract from Brig.-Genl. Wilson's "History of the 3rd A.L.H. Bde." :—

> "The cavalry sword was issued to all ranks of the Australian Mounted Division prior to the final general offensive. The division had received a fair amount of training in the use of the bayonet as a sword for shock action. The bayonet was not however satisfactory. The issue of the weapon was I consider more than justified. I consider that the sword has a great moral effect both on the man carrying it and on the enemy. One of the chief values of the sword is the spirit of progress it inspires in the carrier. He does not allow himself to be bluffed by slight opposition. He rides on feeling that he has a weapon in his hands and 19 times out of 20 finds the opposition only a bluff. With the mounted rifleman on the other hand, his only course is to make a wide flanking movement to induce the opposition to retire, or to dismount and try to shift it with fire action. This all means time or uncertainty, which is exactly what the enemy wants. Take the operations at Huj in 1917. With my late experience I can see what we could have done with the sword there. We were engaged with large bodies of the enemy somewhat disorganised. We had no swords and could only deal with them by fire action. The regiments engaged them at a distance. They took prisoners and inflicted casualties but did nothing really big. If they had had swords, I am now confident that they would have made wholesale captures. *It is not reasonable to expect mounted riflemen to charge positions mounted.*"

The R.H.A. often found difficulty in keeping up with the cavalry over the rough going, and the 5th Cavalry Division pushed on without their batteries on several occasions, but they did good service at Haifa and Abu Naj whilst their absence at Haritan was severely felt.

In this division, batteries were attached to brigades but in the Australian division they were concentrated under the C.R.A. Colonel Preston attributed the success of the charge at Kaukab to the fact that it was made under the covering fire of the concentrated artillery.

It would be interesting to hear the views of artillery officers on this question of concentration or dispersion in operations of this kind.

There is always a certain amount of difficulty in moving large bodies of cavalry at night, but this campaign has proved that this can be overcome by good staff work. The whole of the three divisions were moved up to their concentration point by night. The fourth division from the Jordan valley covered the distance of 65 miles in 3 night marches (11/12—13/14) and made use of the same road as one infantry division and a large quantity of heavy artillery.

The whole corps marched throughout the night of the 19-20th in order to reach its positions as early as possible, and this over an unknown and badly mapped road. Some units certainly did miss their way during this march, but they were at once put right again, and

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of the whole corps, I know of only one squadron which was not in its allotted position by daylight. The distance covered was about 50 miles, and the roads, where they existed at all, were mere tracks.

There were certain conditions which tended to facilitate the task of the cavalry in this campaign, and I think it is worth while drawing attention to them, as illustrating a situation pecularly favourable to cavalry action on a large scale.

(a) We had practically complete mastery of the air.
(b) There was a marked absence of barbed wire behind the enemy's front line and no well organised strong points, or pill boxes.
(c) The enemy had no gas and no tanks.
(d) We could move off the roads almost anywhere, if necessary, though the going was for the most part so bad, that unless in action, it payed to march on the roads, rather than to move on a broad front.
(e) The enemy were weak in cavalry, and those that they had were of inferior quality, and adopted dismounted tactics, never attempting to meet our men mounted.
(f) Throughout practically the whole of the campaign, the cavalry lived on the country, at least as far as necessities were concerned. Sheep and goats, barley and millet, were the mainstay for man and horse.

Military stores and groceries were brought up by lorry as occasion offered from advanced bases.

This point is of interest because the casual observer passing through this country would, I think, have said that it would be impossible to support even one brigade on local resources.

I should now like to put before you a question for discussion. I think you will admit that without cavalry or some other highly mobile force capable of acting far from its base and living on the country, the campaign would have been indefinitely prolonged and probably indecisive. The Turks could have retired to the Sh Saleh—Kakon—Nablus line, which could have been occupied by their reserves long before our infantry could have reached it, and later if necessary to the Haifa—Nazareth—Tiberius line, and thence fought a series of rear guard actions all the way to Damascus.

It is interesting to speculate whether any other mobile force could have taken the place of cavalry in this campaign. I think that mounted infantry may be ruled out. They possess no advantages over cavalry and I have already quoted Gen. Wilson who took part in the campaign, first as a mounted infantryman and then as a cavalryman, to show that in the opinion of one who was born and bred a mounted-rifleman, the sword and lance were a necessary to overcome opposition with sufficient rapidity to secure the best results. I hope there is some one here who will put forward an opinion as to whether tanks alone, or in co-operation in lorries, could have achieved the same results as cavalry.

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I have shown you photographs of the country, and must leave it to others to decide whether or not the greater part of the area over which operations took place ought not to be marked "blue" or unsuitable for tanks.

I must admit, that I find it difficult to envisage tanks possessed of the flexibility necessary to carry out such operations without the assistance of cavalry, and although they could undoubtedly have overcome the opposition met with, I think that their protection whilst passing through defiles, and the rounding-up and handling of a large number of prisoners, would have presented a very real difficulty. On the other hand tanks acting in co-operation with cavalry would have been of the greatest value, especially when attacking mud villages which are common in this country, and they would have been almost essential had the enemy made use of barbed wire, in their rearguard defences.

I have already pointed out that one of the conditions pecularly favourable to the use of a large mass of cavalry in this campaign was their freedom from attack by hostile aircraft, and as this is a condition which is unlikely to occur again in any but small wars, we must look for some means of protecting cavalry against such attacks; apart from a careful study of the tactics to be adopted to counteract this danger, I think that it is possible, that a light cross-country tractor carrying an anti-aircraft gun may in the future form part of the artillery of every cavalry brigade. F.S.R. 128-2 states that "Tanks are not generally suited for co-operation with cavalry in the pursuit", but if money is forthcoming to allow our mechanics and inventors to produce tanks capable of co-operating with cavalry in the pursuit, I cannot help thinking that there is a great future before a combined force of tanks and cavalry, not only in the pursuit but in almost any stage of a campaign.

Before I sit down, I should like very briefly to summarise the achievements of cavalry in Palestine.

The greatest distance covered by any large body of cavalry during the 36 days that the campaign lasted was 500 miles, the rough total of marches accomplished by the 5th Cavalry Division on reaching Aleppo. Two mountain ranges had been crossed and much barren and semi-desert country, where water was scarce. Some 48,000 prisoners had been taken and escorted back to the Infantry. During the whole of this time the cavalry practically lived on the country and were generally 100 miles from the nearest base. The horse casualties in this division amounted to 21% of which about 9% were battle casualties, and the remaining 13% destroyed or evacuated for other reasons.

Although there was a great loss of men due to malaria contracted during the months spent in the Jordan valley, the battle casualties were exceedingly light, and as far as Damascus, only amounted to about 2%.

The prisoners taken by the cavalry alone during these operations amounted to nearly 50% of the whole ration strength of the Turkish

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armies in the field, and this at a cost of a total loss of personnel killed, wounded and missing of about 2%. I think that you must admit that the cavalry in this instance solved the main problem of battle as propounded by Col. Fuller, "the giving of blows without receiving them."

Though I do not wish to suggest that the peculiar circumstances, which made the use of a large mass of independent cavalry the decisive feature of this campaign, are likely to be exactly reproduced in the future, I cannot help feeling that the conditions under which any campaign is probable during the next decade, will approximate more closely to those in Palestine than those in France, and until we can produce machines that can go wherever cavalry can go, and that can achieve everything that cavalry can achieve, we must depend on the man and the horse to obtain really decisive results.

CHAIRMAN: I will now ask anyone who wishes to open the discussion to do so. Would you like to say anything General Gillman, by way of giving them a start?

MAJ.-GENL. GILLMAN: I had meant to say a great many things, Sir, but the lecturer mentioned them at the end, and chiefly the question of arming the cavalry. He stated that some troops were armed with lances some with swords and some with nothing, but he went on to say that he armed the Australians and the New Zealand Mounted Riflemen with swords, and their opinion of it at the end seems to carry the weight that the arme blanche deserves in his opinion. I only wish to know from him if their success in all their charges was due entirely to shock tactics, or if they got a certain portion forward and then, after a period of rifle fire, gained their ground and then instituted a fresh attack; or, was the advance entirely done by charging; that is to say I would like to know if the value of the arme blanche entirely outweighed the value of the rifle in the whole of the operations?

CHAIRMAN: Has anybody else anything to say?

COL. KELLY: Would the lecturer tell us what guns the horse artillery had? Had they 18-pounders?

COL. COMDT. WEIR: 13-pounders.

COL. KELLY: On that question you raised about the breaking up of divisional artillery, I think the new artillery training is rather in favour of breaking up the divisional artillery and allotting artillery brigades to infantry brigades when the division is engaged with several distinct tactical objectives; and I do not see how any cavalry-divisional artillery commander could possibly have assisted his cavalry if he tried to keep the artillery in his own hand when the cavalry was tremendously scattered on very wide fronts and with many different objectives. I, personally, should have been very much in favour of allotting R.H.A. batteries or brigades to the different cavalry brigades.

CHAIRMAN: Does anybody else wish to ask any question?

MAJOR GENL. BANNATINE ALLASON: I do not wish to ask any questions, Sir, but as I was probably instrumental in getting the

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lecturer to come here, I feel bound to say something. I had nothing to say until two days ago when I read a lecture on tanks which gave me some ammunition to fire off this afternoon, but the bombardment will be very short. The lecturer was extremely enthusiastic, all the better for that, but when he wandered into military history he made what I should call an extraordinary statement, that the normal warfare for centuries was a war of position as opposed to a war of movement. I cannot agree with that, although perhaps I am not a very deep student of military history. Then he went on to quote Wellington's retreat to the lines of Torres Vedras, which of course is, at first sight, very different to the campaign we are considering, but it does not imply a war of position. Wellington retired for many reasons. There is a well known French saying, often applied to war,

"Reculer pour mieux sauter!"

That exactly represents what Wellington did, and that does not represent sitting still at all. It is more like taking your horse back to have another go at a fence, and you cannot call that sitting still. You can draw analogies or parallels, possibly, between almost any fights, and at first sight it may seem impossible to draw a parallel between that particular movement and the excellent successful operation, the account of which we have been listening to. Historians have written that this particular movement on the part of Wellington was the finest performance of his career. Further than that, they say that it was, possibly, the turning point of the Peninsular War. I suggest this presumptuous analogy. Is it not possible that historians may write, that the campaign we have heard described to-day was the turning point of the War?

Now as regards cavalry I shall say a very few words. There are people here who can talk about it better than myself. Although it may be usual to make excuses for failures, it is not unusual to make excuses for successes, and I have heard a lecturer before now say that people have remarked that the Turks were "disorganised" when the cavalry moved forward. Well, gentlemen, that is the exact opportunity —the psychological moment for cavalry to be used with rapidity and vigour (Hear, hear). Then other people have said that the Turks had no cavalry. My reply to that is, that the side which had cavalry walked into Aleppo and walked back with 80,000 prisoners and 300 guns, and I do not know of any substitute for cavalry that could have performed that operation. We read and hear of tanks and other things, but I think that if I am going to back a horse in a race, I should back a horse I knew was trained and that had performed before, and I should not back a horse that I knew nothing about and which had never performed before. Of course anything may happen; scientific people, mechanical engineers, may produce anything at some future date; we may all have wings—at least some of us—and we may fly after a retiring enemy. But whether you ride or motor or fly after your enemy, this campaign to my mind, has brought out two outstanding points; one that a force—an army of all arms—properly organised, intelligently directed, and

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led with valour, is an asset of incalculable value to a nation at war. Then the other point which I think very important is, that it shows our training for war was right; founded on sound strategy and sound tactics. The strategy of which the base is to enforce your will on the enemy. That is as old as the hills, because it is said of two of Cæsar's celebrated generals who were chaffing one another that Sulla said to Marius "If you are a great general, come and fight me." Said Marius to Sulla "If you are a great general, force me to come and fight you." Then one of the principal bases of tactics is to go for an initial success and press that success home, as Allenby did in the campaign you have been listening to. (Loud applause).

CHAIRMAN: Will anybody else continue the discussion? Nobody. Well, I will ask the lecturer to answer any points which he thinks necessary.

COL. COMDT. WEIR: As to the point put forward by General Gillman, of course the true answer is that nearly always the operation was a combined operation of fire and sword, or fire and lance, whichever you like to call it.

The truth is that the enormous increase in fire power, which has been given to the cavalry by the introduction of the Hotchkiss gun and by an increased number of machine guns, has relieved the cavalry leader of the necessity of dismounting his men normally to use their rifles in an attack of this sort. He can get all the covering fire he wants; he can get a tremendous fire power out of his 16 Hotchkiss guns, 12 machine guns and his horse artillery whatever it is. Occasions did arise on which the cavalry charged without artillery or machine gun support and got home, but I do not say it is to be recommended. The correct procedure is to push your machine guns to the flank if you can, open a tremendous fire, and then let loose line after line of cavalry at them, and that was the way it was done generally speaking.

I do not think there is anything else, Sir, that requires an answer.

CHAIRMAN: Well, ladies and gentlemen, it devolves upon me to clear up the proceedings. It gives me very great pleasure to come here to-night because it gives me an opportunity of talking to people I have very little chance of seeing; I am much too busy in the War Office.

What I should like to say is that I have got first of all a very distinct message for you from the Chief of the General Staff. There has been since the war a very great deal of rather acidulated discussion on the merits of cavalry in war, and the Chief of the General Staff deprecates this very much. It is rather natural but he asks me to tell you, especially in the situation we find ourselves in now with drastic reductions coming, that he is very anxious that all soldiers should look upon the balance of arms one to another from the broad general point of view of beating the next enemy we are up against, and not from the narrow point of view of one arm only. The real fact of the matter is that there are hardly any officers in existence now who have ever seen

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cavalry at work. The vast majority of the officers who are left now in the army only saw the trench warfare of position on the French and Belgian fronts. Very few are left except senior officers who took part in the great retreat in 1914, or the advance again to the Aisne, or in the Mesopotamian and Palestine Campaigns; and you may really say that we may divide our officers roughly into two very distinct classes, those who know what cavalry can do, and those who do not. There are very few people among our young officers now who have any idea how ineffective a force of infantry is without cavalry and how impossible it is as things are at present to conduct a war of movement without cavalry. They do not grasp how very difficult it is for the other arms even with the assistance of aircraft, to conduct an approach march when they have located their enemy, or to conduct a reconnaissance of that enemy before they decide to attack, or even to carry out the actual battle if they have the slightest doubt about the safety of their own flanks. Many young officers do not know how desperately disappointing it is to infantry, when they have had tremendous casualties and put forth enormous exertions to win their battle, to find out that there is no cavalry there to complete their victory and exploit it.

I think it is very natural that young men should be very deeply impressed with what they have actually seen in the war and that they should imagine that what they did see in France and Flanders is the last word about war, but I think it lies with the older ones of us to get that idea out of their heads, and we must not allow the experiences in France and Flanders to become the foundation of our teaching in the future. There has never been a war which has not tended to modify tactics, sometimes by the genius of a commander and sometimes by an alteration and improvement in weapons, but we must be careful to review the lessons of the late war as a whole and not only from the point of view of the men in the trenches. We know, for instance, that nine out of ten of our small wars there would be nothing of this sort, and I should like to suggest something perhaps which you have not thought of before. I think myself that it is very improbable that there will ever be a war like we had in France and Flanders again, even in Europe. Has it not struck you that there is no nation in the world now, and certainly no General Staff which will voluntarily go into the next war and submit to a war of attrition behind barbed wire with all its inordinate length, enormous casualties, tremendous expense and probably indecisive results? I am quite certain of that myself.

All the best brains in the world, scientific, mechanical and military, are now engaged in the task, some of them directly and some indirectly, of evolving, very slowly perhaps but I think surely, a modern instrument of war, a modern division which will be so much more swift moving and harder hitting than the one we finished up the war with in 1918, that it will make a war of position impossible. Naturally there will be phases of trenches even on the new battlefield; part of it will be in trenches if it is a big one and there will be phases of the campaign where we will use trench warfare, but I should like to quote to you what

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I heard Marshal Foch say to my late chief, Sir Henry Wilson, in his room at the War Office. He said "The nation that goes to war again thinking that it will be able to shelter behind a line of trenches and barbed wire while it forms new armies will meet with disaster"; and he also said to him at the same interview "There is no man living who knows what the division of ten years hence will be like, still less the division of 20 years hence".

Now I think you will agree with me, in fact I am sure you will, that whatever the division or the weapon of the next war is, it will be quicker moving owing to mechanical progress, and harder hitting owing to the improvement in weapons, and that it is aboslutely necessary that it should be; and if that is the case I think you will agree with me that until we advance very much further than we have in mechanical progress an essential part of a harder hitting and swifter moving army is its mounted troops (Hear, hear, and applause).

Now, I want to read you a lesson from something I wrote out just before I came down here. We are now up against the biggest thing we have ever been up against in our army—the biggest reduction as you know the army has ever had to face—it is tragic but it is the business of the Government to settle policy. You need not think that the General Staff have not told them the truth about it because they have. The Government have had to make a very grave decision and we are now faced with greater overseas responsibilities by far than we had in 1914, and to carry them out we have the smallest army we have had for very nearly one hundred years. It is a very difficult and very dangerous position, and the only hope that we have of being able to carry out our task, when we are called upon to do it, is by maintaining what is left of us in the very highest state of readiness and training, and by having in peace time an establishment which will permit us to expand quickly and largely when war is upon us. The latter is our task in the War Office. It is your task gentlemen, to keep in the very highest state of training.

As regards personnel, it means that every officer and every non-commissioned officer must be fitted to slip at once into a higher position than he occupies at present, so that we can from them form new cadres, —the major into command, the subaltern to the battery or the company, the sergeant to the platoon or the company, and the private soldier to the corporal or the lance-sergeant. A tremendous task devolves upon us now, gentlemen, we who are left in the army. We know that the League of Nations are not going to stop war; we know that we may be called upon at any minute and it rests with you younger officers, and you, older ones who teach them, to see that we produce that army of experts from which we can create a bigger one when we want it.

It means also that as regards the proportion of arms one to another, into which this lecture has entered, we can maintain no frills whatever; we can afford absolutely nothing that does not fit exactly into its place and pull its full weight when the bell rings. That is why we have been

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forced to discard cavalry in rather large numbers and guns and so on up to the very danger point I admit, but we are not alone in it. The Italians have reduced themselves to 12 regiments of cavalry only in the whole army, and the French have come down from 70 something to about 52—do not quote these figures because I am not quite certain but it is something as big as that—the Indian Army have reduced 18 of their cavalry regiments; we so far have only reduced four and we have now got to reduce five more, nine altogether, so that we are not alone in this matter. We are all doing the same thing in the effort to remove anything which does not fit exactly into proportion with the other arms we keep.

Again, to produce that highly skilled army we want, we have to strike the correct balance between what prepares the way for the infantry attack, the guns and aeroplanes, tanks, gas, smoke and so on; we have to strike the correct balance between them and the infantry, and one of our principal tasks is to strike the correct balance between the weapons of the infantry, the machine gun and the Lewis gun and the trench mortar and the rifle. Now, we know a good deal about these things in the way of position and trench warfare, but there is no man living who has got more than ideas about those things in the open warfare of the future. Colonel Weir has told you what happened in more or less open warfare in Palestine, but that is not the least like what the open war of the future is going to be. No man has seen that even in the five years of this war, and no man knows yet what modification of our tactics the use of all these new methods of warfare in an open campaign will bring about against an enemy equally provided and equally armed, which the Turks in Palestine were not.

We tried to make a beginning last year in the solution of these problems by starting the Experimental Brigade at Aldershot, but Ireland and the strikes threw it up,—we could not do it. This year we hope to make a real start with the Experimental Brigade and to follow it with a division next year, whose sole task is to study the organisation and tactics of open warfare, first of all against an enemy unprovided with modern means of war, like we should have to meet in India and the Near East, and, secondly, against an enemy who are fully and equally provided with them. There is not a single general in the army now, or a single commanding officer who knows how he would use tanks in open warfare. I give this as an instance, and we have never done it. You have done it in some of the open warfare in France to a certain extent but the tanks very soon lagged behind. We hope to have a new and better tank in the spring; they are being tried out at Aldershot now, and instead of going five miles an hour or possibly 7 or 8 as the last one did that we never actually used in the war, we have got one now which goes very nearly 20 miles an hour and is sprung.

We hope as you gunners know, to make a start with the mechanicalisation of artillery next year at Aldershot; we are going to mechanicalise one brigade of artillery merely as an experiment, and we are going to experiment with cross-country mechanical transport

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that we hope eventually will result in our being able to put the infantry into battle and allow the infantryman to march with very little on his back except his rifle, his ammunition, and his water-bottle—all designed you will observe to make us swifter moving and harder hitting.

The old division was built up round the single man with the rifle. Now we build up our divisions rather round the machine gun— a group of men with a machine gun, but whether the division of the future will be built up round the machine gun or round the tank or what not, we do not know. The chief of the General Staff has issued a training letter to you and every command abroad and at home, and he is most anxious that every thinking soldier will put his mind to these great problems of organisation and tactics of the future. I think such lectures as we have had to-day, and the resulting discussions are one of the best ways we can have of clearing the air about them. I think we have come to one conclusion this afternoon and that is that if our army is to be made quicker moving and harder hitting we are all agreed that we must have mounted men for the present. (Hear, hear, and loud applause).

GENL. GILLMAN: In the name of those present, Mr. Chairman, I should like to move a very hearty vote of thanks to the lecturer for the intensely interesting and excellent lecture he has given us. (Loud and continued applause).

GENL. BANNATINE ALLASON: Before we pass may I ask you to give a very hearty vote of thanks to the Chairman, Sir Philip Chetwode for coming here and giving us the excellent address which he has given, and the enormous amount of information which he has added to it. May I say on your behalf that we hope that this is not the last time we shall see him. He is certain of a hearty welcome and I think he likes to come. (Loud and continued applause.)

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THE BATTERY STAFF; A REVIEW AND SOME SUGGESTIONS.

BY CAPT. G. L. KAYE, M.C., R.F.A.

THIS subject is one of the most controversial in regimental matters, especially since the war. Everybody has his own ideas of how the battery staff should be constituted and how used; therefore, any scheme, no matter who may be the originator, is bound to be both severely and adversely criticised. This is certainly borne out by the shower of criticisms, that have descended on the new methods laid down in Chapter VI of Artillery Training Volume I :"Reconnaissance and Occupation of Positions".

The reasons for this abundance of controversy are not hard to find. In the first place, before the war a maximum establishment was more or less laid down for the battery staff, but the methods of its employment were only generalised. It was left largely to each battery commander to perfect his own methods and to fix the details of his organisation. A fair amount of latitude was allowed, and very naturally, as often as not each battery staff had its own particular way of carrying out its duties. In the second place, no apparent attempt had been made to co-ordinate different methods adapted to various types of country and various conditions of warfare.

It is obvious now to what results this former haphazard policy led to. In peace time, a member of one battery staff, on being posted to another battery, had frequently to learn his job almost afresh. This may not have made itself much felt at the time, but in war, when reinforcements are constantly being required, the lack of immediate efficiency becomes a serious matter.

The other shortcomings of our pre-war system were well known during the war. On their formation, the new army batteries had very little in their drill books, from which to learn this special part of a battery's work. In consequence, the training and efficiency of their staffs were generally behind-hand; and this training, being almost entirely specialists work, and at the best of times a lengthier and more difficult process, lagged behind that of the gunner and driver. When regular officers were posted to these newly formed batteries and took over their training, they naturally organised their own staffs in the way they themselves had been accustomed to before the war began, modified by any war experience they might have gained. The net results were still a somewhat heterogeneous system of battery staffs throughout the Regiment.

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There are now standardised methods laid down in the training manual. It is a pity that the great volume of opinion on these methods from battery commanders, which ought to have been forthcoming this last summer, was practically unobtainable at home, since the majority of units did not practice. Nevertheless, a certain amount has been available from among the pack, medium, Territorial and Irish Batteries. There certainly are controversies, but discussion and healthy argument are valuable; for it is only from the collation of the experiences of officers, who have served in the different theatres of war, that the best standard methods can be evolved. The Mesopotamian campaigner may emphatically assert that the present drill tends to slowness; the Western Front warrior may consider that too much responsibility is given at times to junior subalterns. Much can be said by both; it is the work of the powers that be to co-ordinate their inferences, and so evolve a sound basis for training in the future, which will stand in good stead for fighting in any part of the world.

It is proposed to review the subject under discussion as follows :—

1. Organisation.
2. Equipment.
3. Employment.
4. Training.
5. Interior Economy.
6. Future possibilities.

1. *Organisation.*

It must be realised that standardisation of organisation as well as methods is essential, in order to facilitate the rapid training of new armies in time of war. The following extract is re-printed from page 311 Artillery Training Volume I :—

Battery Staff.

B.C's Party	"A" Group.	"B" Group.	Capt's. Party.
1. B.C's Horseholder			
2. N.C.O. i/c Signallers.	4 Signallers.	4 Signallers.	B.S.M
3. B.C's Assistant.	2 Horseholders.	2 Horseholders.	B.Q.M.S.
4. G.P.O's Assistant.			Farrier.
5. Horseholders for 2 and 3.			Captains's Horseholder.
6. Horseholders for G.P.O. and 4.			

Total ... 22 other ranks.

As will be seen, with the exception of the B.S.M., B.Q.M.S. and B.C's horse-holder, all other members of the staff require to be horsed; that is to say, the three above mentioned are the only ones definitely allotted horses in the latest Provisional War Establishments for an 18-pdr. battery. The number of un-allotted horses required is accordingly 19. Now these Provisional War Establishments allow only

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18 un-allotted riding horses. The following extract is taken from them :

Look-out Men	2
Mounted Orderly	1
Signallers	6
Patrols	3
Spare	6
Total available "riders" not already allotted	18 horses.

Probably the best way to make up the horses to 19 would be for the B.C's assistant to have the spare sergeant's horse. There is no "rider" for a mounted orderly, should one be eventually allowed as an addition to the establishment already laid down in Artillery Training. It is worthy of note that in the Provisional War Establishments a riding horse is allotted for a mounted shoeing smith, but none for the farrier. The reason for so doing is not altogether clear, yet perhaps it was considered that the war time farrier is likely to be past the age, when he can usefully be accomodated with a horse! Still, the extra horse for the M.O. could be found, by dismounting the shoeing smith. The keen eyed reader will also perceive that the individuals enumerated in the extract from War Establishments are still at variance with those from Artillery Training.

On the whole it must be admitted that the present organisation does and can supply the needs of light and medium batteries.

As regards heavy batteries, of the 8-inch and 9·2-inch Howitzer and 6-inch gun type, since these batteries may yet frequently be split up into sections, certain increases would seem to be necessary. The number of signallers might well be raised to 12, and an additional B.C's assistant allowed for in their establishment. Pack and Super-Heavy batteries are not being considered.

No mention is made of wireless operators, and it is therefore presumed that they will, as before, be found by the R.A.F., and attached to batteries. Picked signallers could be and often have been trained sufficiently to make useful wireless operators and they would still be available for other duties in peace and when not in action. The R.A.F. have a very excellent wireless training school at Winchester, and, if they were agreeable, a start perhaps could be made in the form of wireless courses for R.A. signallers.

2. *Equipment.*

The equipment as carried at present is laid down in Artillery Training Volume I Appendix II, and the following points arising under this heading may be worthy of notice :—

(a). It is questionable whether the Angle of Sight instrument allotted to the G.P.O. is of sufficient use to warrant its being still carried. The one per brigade now allowed should certainly suffice.

(b). Neither the N.C.O. i/c signallers nor his equipment are mentioned in this Appendix, but in order to be correct over small

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details it is thought that he ought to be "put down for" a pair of field glasses.

(c). Signallers: it is obvious that they themselves cannot carry more wire than is already allowed for. The total length actually carried by the two groups is $1\frac{2}{3}$ miles, but this of course is not enough in itself. Spare wire is generally carried on some of the ammunition wagons and some besides in the G.S. wagon. For horsed batteries, a pack horse fitted with a saddle equipment similar to the one used in an Infantry Brigade Signal Section would be of immense value. This carries six drums of $\frac{1}{2}$ mile each of D III cable; these drums are just light enough for one man to pay out, using a hand spindle, and considerably lighter than the heavy drums carried on the Artillery Brigade H.Q. telephone cart, which require two men to carry them on a spindle. An additional two miles on four spare drums could be carried on the wagons, for the use of detached sections. The writer remembers being asked for suggestions in the autumn of 1914 and putting forward this proposal for a pack horse and saddle equipment. Many other suggestions were made at the time, but the only resultant innovation to his knowledge was the issue of a remarkable set of "one-man harness," which, when put to practical use failed to a marked degree. It is understood that trials are now proceeding with some sort of pack saddlery equipment, but possibly this may be only intended for pack batteries.

On the other hand, taking into consideration the signalling equipment likely to be carried in the future, then a light horsed cart may well be needed. This could carry practically all signalling and wireless gear, and in addition a Lewis gun for the battery staff. Present ideas seem to trend in this direction, and for the cart to be of the limbered type. There certainly ought to be fittings on the rear of both limber and body for paying out and reeling in drums of wire.

There are not a few who think it a mistake to have given up carrying a heliograph. Two might well be carried in the signal cart, and they are immensely useful signalling instruments. Lamps fail, when cells run out, but the advantages of the helio are well known to everybody, who has soldiered in the East. They have been used by the writer in France.

It cannot at the moment be expected that a third director will be issued to batteries, but for detached section work, for instructional purposes, and as a spare it would certainly add to the completeness of the equipment.

The stereoscopic double armed observing instrument was an excellent war issue, but it is not mentioned. It ought not to be forgotten.

If an observation wagon with periscopic extension is to be issued, it would be of great value. At the same time it is not considered sound policy that it should be used to carry all the instruments and gear not already carried on the men. Wireless instruments and such like, when not required for use at the moment, are better out of the way, rather

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than in an exposed position, such as one that would frequently be taken up by an observation wagon.

3. *Employment.*

(a). The alteration of the B.S.M's duties in the new Artillery Training is almost the first thing to attract attention, and it certainly has done so. He is now used alternatively as an orderly, a guide to the battery, and captain's assistant. One cannot help feeling that in such a capacity the man, who would be normally the most reliable and experienced soldier in the non-commissioned ranks, is rather wasted. True, he resumes his place and full authority in the wagon line in stationary warfare, but in moving and semi-moving warfare he will surely be missed in his old place. It has only got to be remembered what the B.S.M's job was on manœuvre under the old system. He looked after the staff and kept it together, put it right when it went wrong, gingered it up when needed, and in a very useful way superintended the smooth working of that part of the unit. It would be difficult to find any one else to do it now as efficaciously; the B.C. cannot, for he has too much to think about and do; likewise the B.C's assistant. The book doubtless intends that the N.C.O. i/c signallers should fill the place; he is nominally in charge of the B.C's party. But he has much to do besides in the supervision of communications, and it seems doubtful whether in time of war he would be a sufficiently experienced N.C.O. The example and steadiness, of an old and experienced warrant officer such as the B.S.M. during moving fights is of incalculable value among the staff. In peace, he used to be of great assistance in the training of the staff. Now he is somewhat deprived of a good deal of the technical work in connection with it, and he may soon come to be regardless of the specialist knowledge of the individuals that make it up. Consequently, he is likely to become of little assistance in their training. It would be welcome in some ways to see the B.S.M. back in his old place, in the fore-front of battle—a trusty rudder in the control of the B.C. at the wheel, that will keep the staff on its right course. If any other man of less importance can perform his present duties just as well, it indicates rather a waste of man power, which special kind is very limited.

(b). The B.C's assistant has to be almost a superman; his duties can be multitudinous. In short, he has to be a first-class N.C.O. and may unavoidably have to be the spare sergeant. Any other N.C.O. of less experience and junior rank would seldom be up to the work. As exemplified by the French artillery, it is not too much to expect of a N.C.O. In the writers opinion, one of the faults of our system is that not enough use is made of the N.C.O's intelligence. Only too often is he judged solely on his capacity of keeping the men under him in a good state of discipline and able to perform their duties in a efficient manner. Things frequently are allowed to stop at that, and not nearly enough N.C.O's are encouraged to go further. One need only go back as far as the South African War to realise how this even extended to

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the commissioned ranks. Exploitation of human capabilities to the utmost, and care to put round pegs into round holes; this should be the keynote of our method.

(c). The battery leader has a great deal of responsibility thrown on to his shoulders, when a change of position occurs (see Artillery Training Volume I page 331). It seems hardly necessary that it should always be so, for a single sentence added in the book would qualify it considerably—"In the absence of the Captain, he will decide, etc." It is not at all impossible that the captain would be there at the time the order to move was received, and in that event, it is only logical, that, he being the senior officer on the spot should make the necessary decisions. Whatever may happen in peace, there are not going to be large numbers of experienced subalterns for long in any war. As often as not, the battery leader might be a raw youngster, and, willy-nilly, he might have to go and seek advice, if he could get it, as to the best methods to adopt.

(d). Artillery Training is very sketchy over the retirement; it always has been, but no precedent need have been created on that account. It is the most difficult manœuvre to carry out, and likewise it is far from easy to legislate standard methods for it, suitable in all cases. This doubtless accounts for the paucity of instructions given as to the method of procedure. Yet it is possible to arrive at a satisfactory standard method, and there are no doubt many brains which feel up to finding it a place in the drill book.

The main point seems to be the lack of a mounted orderly to accompany the G.P.O's party. He could be used to meet and guide the battery instead of the B.S.M. The latter could be left at the new O.P. to watch the tactical situation; this would leave the G.P.O. free to get to work at the battery position, before the guns arrive—namely to resect, work out his line, etc. This necessitates that, whoever carries the plane table and stand, should be included in the G.P.O's party.

4. *Training.*

(a). The B.C's assistant's knowledge would not appear to be misrepresented in the following category of subjects :—

(i). Lines of fire—Map and director work.
(ii). Observation, simple ranging, and fire control.
(iii). Use of the Range Table, and working out Meteor corrections.
(iv). Use of the Slide Rule.
(v). Orders, Codes and Recording.
(vi). Range-taking.
(vii). Panorama Drawing.
(viii). Good knowledge of certain chapters in Artillery Training Volumes I and II.
(ix). Semaphore and Buzzer.
(x). Lewis Gun.

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This little catalogue entails, as will be readily understood, very considerable training; but even if perfection is not arrived at, it should be possible to produce a really efficient B.C's assistant. The difficulty which presents itself is to get the right type of man, and to standardize the training as far as possible. The latter might be largely overcome by having B.C's assistants courses at the School of Artillery; possibly N.C.O's from the Gunnery Staff Courses might be selected to undergo a further course for this purpose. The subject has been already broached, but so far it has not been found possible to undertake it. Alternatively, classes might be formed in each command, but this would not be easy to carry through. Coast Defence districts still appear to have their Instructors in Gunnery, but the excellent proposal for the attachment of Instructors in Gunnery to Commands has so far come to nothing. Had this been otherwise these Command Courses, as suggested above, would become more feasible. It would be a great step towards raising the standard of efficiency of N.C.O's throughout the Regiment, if a well trained body of B.C's assistants could actually be produced. They surely do exist in the French Army, why not in the British Army of long service men?

The B.C's Assistant by virtue of the knowledge and responsibilities expected of him ought really not to be below the rank of sergeant, if he is properly used in the way the drill book apparently intends him to be used. It is perhaps unwise in these days, to suggest that he should receive a small increase in pay, were he to pass satisfactorily as a fully qualified B.C's Assistant. He would well deserve a higher rate, were he to reach a really efficient standard, and there would thus be a further incentive to all N.C.O's to study gunnery with much greater keenness and perseverance. The Navy set us a good example in this matter; they have their fixed standards for each rating, a course for which, in the "gunners" branch at any rate, must first be passed before pay can be drawn and the rank confirmed. Their system is very complete and works smoothly. It is of course more extensive than any that could usefully be applied to the Regiment. Nevertheless, it suggests possibly some line for experiment, which might lead to improvement in the training of N.C.O's.

Unfortunately, in a war on a large scale the first class B.C's assistant will be among the first to be commissioned from the ranks; possibly even in peace time a few might get the chance. For this reason, it is most expedient that there should invariably be an understudy.

(b). The G.P.O's assistant suggests himself as the understudy for the B.C's assistant. The job could be properly filled by quite a junior N.C.O. His training could for the most part be carried out on similar lines to that of his "principal", and the latter, if a fully qualified and first class specialist, would often be the best man to teach him.

(c). The number of signallers for a light and medium battery is still placed at twenty-one in War Establishments, including a lance

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sergeant and one or two other N.C.O's. Out of this number it would be extremely difficult to get more than twelve fully trained signallers; the remainder would probably be only trained in semaphore, buzzer, as telephonists and linesmen. This ought to be sufficient, and at any rate it is probably the most generous ever attainable. Three signal groups are very desirable, but it does not seem likely that they ever could be all mounted.

The N.C.O. i/c has to be a thoroughly first class man; his job in war is a vital one. On him and on the signallers a battery's efforts against the enemy frequently depend. The signallers are as a rule a very good set of men, chiefly because in their preliminary training the "duds" are weeded out from the classes. They generally have a very high sense of duty as is well exemplified by the number of decorations won by them in the last war. Their worth is not always appreciated as it might be. It always seems rather hard lines that their promotion beyond the rank of lance sergeant is seldom possible. However good signaller N.C.O. a man may be, it does not necessarily follow that he would make a good No. 1, hence, his further promotion is not likely.

Three of the trained signallers ought to be practised as wireless operators, including the practical care, adjustment, and preservation of the receiving set.

(d). The training of mounted orderlies is important, although one is not allowed at present in the staff. The best of these might be selected to understudy the G.P.O's assistant.

(e). Broadly speaking in connection with training, standardisation should once more be aimed at. However highly trained a staff may be, it is of little material value, if it is trained merely to carry out certain pet fads and fancies. The peace time training of the regular army should be the model for the war time training of a national army.

Communications proved to be of vital importance in the Great War, and as far as can be seen their importance does not appear likely to become less. Casualties to battery staffs are often high, and for this reason understudies must not be neglected during training. Above all things the best possible equipment must be provided. To be efficient, things must be up-to-date. All artillery work tends nowadays to become more technical and difficult; it is hard to say what the future will disclose for the men at the guns. Simultaneously, there will probably be more need for specialists, particularly in the non-commissioned ranks. It is to be hoped that more time will then be available for them to perfect themselves in their specialist work, without lowering the standard of discipline in the unit.. How many days of wasted time and energy could be written up in the black book of the army yearly? Economy of man power, conservation of energy except in that direction where really required, and every man in his right place: these are sound principles.

If, behind the murky curtain of the future, horses may no more be seen with artillery, then the Regiment will approach yet nearer to a condition of things appertaining to the senior service. In such an event

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it is again urged that their brains be picked and their methods scrutinised.

5. *Interior Economy.*

(a). In Artillery Training Volume I, at the bottom of page 310, the following statement may be read :—

> "*For manœuvre* the battery is divided into :—(i) Battery Staff", etc.

The two words are here underlined, for it is strongly advocated that the battery staff should be organised separately *for all purposes.* In the Provisional War Establishments compiled since the war this has apparently been done; it is to be hoped that it will soon be made law. This Headquarters Section would be commanded by the G.P.O. or the battery signalling officer. The establishment referred to is as follows :—

Headquarters Section (18-pdr. Battery).

Major	1	Signallers	21
Captain	1	Gunners for Battery Staff	6
Subalterns	1	Lewis Gun Team	6
B.S.M.	1	Sanitary Orderlies	2
B.Q.M.S.	1	Cook	1
Farrier	1	Clerk	1
Sergt.	1	Storeman	1
Saddler	1	Drivers	13
Fitters	2	Batmen	3
Trumpeters	1		
Total—3 Officers.		63 Other Ranks.	

The two fitters might well be transferred to other sections. The name battery staff might still be retained as that part of the Headquarters Section, which is enumerated in Artillery Training Volume I on page 311.

The principle, which seems to be indicated, is to maintain as far as possible in peace time a more or less complete headquarters section, well trained and efficient. No matter what the peace strength of the battery may be, this section should always be strong. Possibly there might only be one other section besides in the peace unit.

Nevertheless it is comparatively easy to expand it to three sections on mobilization with good material, but it is extremely difficult to produce suddenly an efficient battery headquarters and staff out of next to nothing already existing, however good the reservists may be.

There has always been a tendency to treat signallers and other specialists as nobody's children. They often have to be distributed among the sections for stables, etc., and then perhaps they are told in a forcible manner by a fire-eating No. 1 that they don't get down to it,

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probably because they have missed several stable hours that week, when on signalling parades. Result—bad grooming on the part of some signallers! In the fourth section they would have their own horses to look after, and their own N.C.O's to maintain discipline. This would soon create "*esprit de corps*" among them, and the prestige of the headquarters section would be in the ascendant.

Certainly during the war they invariably lived together, and often enough sorted themselves out quite automatically into a separate little sub-section. But the discipline was lacking, because they had no standing as such. Nos. 1 of sub-sections were only too glad to be rid of them, for they found themselves with quite enough on their hands in action. Give them their standing as a separate section, and discipline would not suffer. The signallers' duties were often very arduous on service. Their number frequently got low through casualties, and the severity of their work was not always appreciated by their Nos. 1. A man might have been out on a line all night, and when he got back, be promptly put on a job of work, because he was only a signaller. His own N.C.O. was too frequently only a corporal, and so had no say in the matter. The company in an infantry battalion has got its headquarters organised separately, and it has been proved sound. It does not follow, of course, that it would prove so in the case of a battery, but it should be worth trying out.

(b). Under this head there arises the question of the B.S.M. and the B.Q.M.S. It is a troublous one, and extends beyond the scope of this paper; but it has its bearing on the work of the Battery Headquarters, and accordingly will be touched on. The matter appears to resolve itself into having separate lists for promotion to B.S.M. and to B.Q.M.S. and to R.S.M. and to R.Q.M.S. respectively. It is well known that an excellent B.Q.M.S. may not make even a passable B.S.M., and it is easy to understand that such can be the case. Since the war the work of the B.Q.M.S. has increased, and with his present responsibilities his rank might well be that of a Warrant Officer Class II. Otherwise, as an alternative, retaining the present Staff Sergeants rank for B.Q.M.S., let there be a R.Q.M.S. on Brigade Headquarters, similar to the Quartermaster in an infantry battalion, except that he need only rank as Warrant Officer Class I. If such were the case, battery commanders and quarter-master sergeants would be relieved of an enormous amount of "Q" work, which would enable them to devote themselves more to the training of the battery; in effect, in many other ways, it would relieve pressure all round. It is not proposed to discuss the pros. and cons. of the question, but there must surely be a large mass of opinion in favour of it, and it is only by constantly bringing it into the lime-light, that there can be any hope of the experiment being given a trial. It is sound reasoning to think that any change, which may be beneficial to the unit as a whole—and in this case the brigade is included—is worthy of favourable consideration.

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6. *Future Possibilities.*

The question of what is to befall the battery staff in the future with batteries possessing really mobile mechanical traction is the last point to be touched on. If any batteries are to be permanently mechanicalised, it is obviously unsound to keep the staffs of these batteries horsed. One of the great advantages of modern tractor power is the rapidity with which guns can be cencentrated for a battle from long distances away. The ability to execute a rapid march of 40 or 50 miles in an afternoon in order to get into action the same night and be ready to fire a barrage at dawn, adds enormously to the power of modern artillery. But in such an event where would the staff be, if they were on horses? One can only suppose that they would probably be still on their horses somewhere on the road, when they were wanted. Not only must they be able to accompany the battery at its full road speed for a long distance but they must be able to outstrip it, and reach the position, if possible, an hour beforehand, while it is still light enough to reconnoitre and resect, etc. Batteries of this immensely mobile type could be flung into the line wherever required with speed not dreamt of before the war. The difficulties thus incurred would be those of staff work in connection with traffic control and ammunition supply. The first does not appear insuperable, when it is remembered that good progress could often be made off the roads, when a hitch occurs. In the second case the ammunition would exist in large dumps. One ammunition tractor with each battery could quickly transfer the necessary ammunition from the dumps to the battery position, during the hours of darkness. There is no getting away from the fact that the staff must have motive power, if the guns get it.

The following transport is suggested to meet the present requirements of the staff in a mechanical battery. There are many solutions, and the best can only be arrived at by trying different methods in the next few years; a start has now been made.

Mechanical Battery Staff.

1. Cross country cars—2; B.C's and G.P.O's.

B.C's Car.

B.C.
B.C's Assistant.
N.C.O. i/c Signallers. Driver. (Instruments, etc.)
1 Officer and 3 Other Ranks.

G.P.O's Car.

G.P.O.
G.P.O's Assistant.
B.S.M.
Driver. (Instruments, etc., including plane table).
1 Officer and 3 Other Ranks.

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2. Cross Country Vanettes—3; A Group, B Group and Wireless.

A Group Vanette.

4 Signallers.
Captain.
B.Q.M.S.
Driver. (Spare wire, Instruments).
1 Officer. 6 Other Ranks.

B Group Vanette.

4 Signallers.
Asst. N.C.O. i/c Signallers.
Wagon Line N.C.O.
Driver. (Spare wire, Instruments).
7 Other Ranks.

Wireless Vanette.

3 Wireless Operators.
4 Spare Signallers. (C Group.)
Driver.
(Wireless Equipment, etc.)
8 Other Ranks.

N.B.—The cross country vanettes to be all fitted with an attachment at the rear of the body of the car for paying out and reeling in wire.

3. Motor cycle Despatch Riders—2.

Total—29 Other Ranks.

It would, of course, be necessary that all officers, possibly all N.C.O's, and some of the signallers should be able to drive the cars in case of casualty to the driver.

In considering the methods of employment of such a staff, in order to economise in vehicles, it is felt that, whatever means may be adopted, certain individuals would have to change cars at certain times according to the particular manœuvre being carried out. This seems quite feasible, and should not present any serious difficulties. If the horse of the future, as typified in Lieut.-Colonel Garwood's contribution to the "Duncan" Essay this last year, ever comes to be put to practical use, such a machine would be the mount for the despatch rider working with the staff. The second despatch rider would generally be required for carrying orders and messages to and from Brigade Headquarters and other formations.

If, in the present method of reconnaissance and manœuvre laid down in Artillery Training, the various individuals on horses are replaced by groups of these individuals in cars and vanettes on the lines

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suggested above, it is astonishing how comparatively simply things seem to work out. A mere alteration of a few details and the present drill will be found easily adaptable to a mechanical battery staff. If the ideal vehicles can be produced, one might even go further and say that the whole system could be made simpler and quicker; for instance, in the laying of telephone wire. At any rate this form of manœuvre will be interesting to study at the practice camps of the future.

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ACCURACY OF AEROPLANE BOMBING.

BY CAPTAIN H. R. KILNER, M.C., R.G.A.

THE following is a summary of certain trials carried out by the Army and Navy Air Service of the United States to determine the vulnerability of modern warships to bombing attacks from aeroplanes. Attacks were delivered against four German vessels at anchor—a submarine, a destroyer, a cruiser and a battleship.

The results can be summarised as follows :—

A. *Attack on Submarine U-117 at anchor.*

Length 267 feet, Beam 24 feet, Draught 13 feet.
1st Attack—3 F.5.1. seaplanes dropped 12, 170 lb. bombs.
Submarine sank in nine minutes.
Height of aeroplane not reported.

B. *Attack on destroyer G-102 at anchor.*

Length 312 feet, Beam 30 feet, Draught 9 feet.

1st Attack—Formation of S.E.—5 pursuit planes dropped 44, 25 lb. fragmentation bombs from 200 feet, obtaining 21 hits.

2nd Attack—Formation of DH4 Bs. carrying 100 lb. bombs dropped seven bombs without hitting. Height of machines not reported.

3rd Attack—Formation of Martins at 2,000 feet dropped 44, 300 lb. bombs obtaining 3 direct hits. The destroyer sank in two minutes after being hit, and twenty minutes after the attack developed.

C. *Attack on cruiser "Frankfort" at anchor.*

Length 465 feet, Beam 45½ feet, Draught 17 feet.

1st Attack—Six Navy bombers dropped 12, 250 lb. bombs obtaining one direct hit. Height of machines not recorded.

2nd Attack—Two Army bombers dropped 12, 300 lb. bombs from unrecorded height. No direct hits were obtained, but several were close alongside.

3rd Attack—Three F5L's dropped 6, 250 lb. bombs from unrecorded height. No direct hits were obtained.

4th Attack—One Martin dropped 6, 300 lb. bombs from unrecorded height, obtaining one hit.

5th Attack—Three F5L's dropped 6, 250 lb. bombs from unrecorded height. No hits.

6th Attack—Three Martins dropped 12, 300 lb. bombs from unrecorded height. No hits.

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7th Attack—Formation of Martins dropped 10, 520 lb. bombs from unrecorded height, obtaining two hits.

8th Attack—Six Army Martins dropped 14, 650 lb. bombs from unrecorded height obtaining two hits. One bomb burst close under the port bow and stove it in. The cruiser sank in 20 minutes.

D. *Attack on Battleship "Ostfriesland" at anchor.*

Length 546 feet, Beam 93 feet, Draught 27 feet.

1st Attack—Formation of DH4B's dropped 9, 250 lb. bombs from unrecorded height, obtaining 1 direct hit.

2nd Attack—Formation of F5L's dropped 7, 250 lb. bombs from unrecorded height, obtaining 1 direct hit.

3rd Attack—Formation of F5L's dropped 11, 250 lb. bombs from unrecorded height. No hits.

4th Attack—Formation of Martins dropped 11, 600 lb. bombs from unrecorded height, obtaining 1 hit and five alongside.

5th Attack—Formation of F5L's dropped 12, 250 lb. bombs from unrecorded height, obtaining 2 hits.

6th Attack—Formation of Army planes dropped 5, 1,100 lb. bombs from unrecorded height, obtaining 3 direct hits and 2 alongside.

7th Attack—Formation of Army planes dropped 7, 2,000 lb. bombs Two dropped close in under the stern and quarter and blew in the sides. The ship sank in four minutes. One bomb scored a direct hit on the bows and caused great damage.

Height of machines not recorded.

Note.—The decks of the cruiser and battleship were heavily armoured whilst those of the destroyer and sumbarine were unprotected.

Remarks and Conclusion.

The tactical measures to be taken in the Anti-Aircraft defence of a vulnerable point will depend very largely on the height at which the hostile aircraft may be expected to deliver their attack. They must descend until there is a reasonable chance of hitting their objective, and this will depend upon the size of the target, and the accuracy which has been attained in bomb-dropping.

Very little is known at present as to the degree of accuracy with which bombs can be dropped from an aeroplane, and any conclusions which can be drawn from an examination of the above report may prove of value in predicting the probable height of attack, and thence deducing the best position for siting the defensive arms. The object of the trials outlined above was primarily to discover the destructive capabilities of the aeroplane bomb when employed against both armoured and unarmoured ships of war, but it is justifiable to suppose that the pilots selected to carry out these operations were reasonably expert at bomb dropping, and therefore conclusions may legitimately be drawn from the results obtained. It is unfortunate that in the above report the height of the attacking aircraft is so frequently omitted, as this is

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necessarily the most important factor in assessing the results, but from a general examination of the trials and the data that are recorded, it may be assumed that the "Frankfort" and "Ostfriesland" were attacked from a height which was at most 4,000 feet to 5,000 feet, and probably less.

In all cases the targets attacked were ships which are long and narrow, and in consequence their beam is probably the most important measurement to consider when reviewing the results.

Examining first the results in the case of the "Frankfort" and "Ostfriesland". Their beams were 45½ feet and 93 feet respectively and the percentage of hits obtained approximately, 8% and 16%.

Assuming from this that the percentage of hits obtained from a given height varies directly as the beam of the target, a beam of 285 feet would be necessary to obtain 50% of hits, and if the height of the attacking machines can be taken to have been in the neighbourhood of 4,000 feet, it would appear that the beam required to obtain this percentage of hits is about 7% of the height of attack.

This result is based on a great deal of assumption, and must be accepted with reserve, but it is interesting to apply it to the attacks on the destroyer G-102.

The beam in this case was 30 feet, and approximately 50% of hits were obtained in the first attack from a height or 200 feet. This gives a factor of 15% of the height. In the second attack from 2,000 feet, 7% of hits were registered and to obtain 50% would have necessitated, on the above assumption, a beam of 215 feet, or 10% of the height.

From the above it appears improbable that there is any direct linear law connecting the 50% zone and the height of attack, but if an approximate figure be required, it would seem reasonable to assume the figure 10% ,i.e. that an aeroplane will drop 50% of its bombs within a circle whose radius is 5% of the height of the aeroplane.

The attack on the destroyer is of additional interest because the target corresponds in its dimensions to a bridge of moderate size, which will form a frequent objective for hostile attack from the air, and if the results of this trial can be accepted it would seem that the attacking machines must be prepared to descend to very low heights indeed, if they are really determined to effect its destruction.

It must not be forgotten that in these trials the targets were stationary, the weather conditions were favourable, and the attacking machines were unharassed by A.A. fire or hostile attack.

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THE DEVELOPMENT OF ARTILLERY TACTICS—1914—1918.

BY LT.-COL. C. N. F. BROAD, D.S.O., R.F.A.

CHAPTER IV. 1917.

The first event of 1917 was the German retirement to the Hindenburg line. This movement was designed to bring into practice the new tactics for which the Hindenburg line had been made and also, probably, either to delay the Spring offensive, which was known to be intended in this area, or cause it to be made with less preponderating artillery.

The advance only lasted about a month but it was fruitful in useful lessons. This was due to the fact that it was a miniature campaign compressed into a small space of time and country.

The advance may be divided into three distinct phases.

i. The slow and methodical advance of a mass of artillery over cratered ground with the object of attacking a heavily wired defensive line.

ii. The rapid advance or pursuit of the enemy developing into advance guard actions against lines of villages.

iii. The reinforcing of the advance guards as they came up against the Hindenburg line, and eventual deployment of all the available artillery for the attack of that line.

The main lessons which we learnt were as follows :—

i. The mobility of the heavy artillery was firmly established. Both in bad and good country it compared very favourably with the Field Artillery.

ii. The facility of ammunition supply decides the number of batteries to advance.

It is worse than useless to send forward more batteries than can be supplied with ammunition as it only increases the congestion and delays the other traffic.

It must be decided beforehand what amount of artillery will be required or how much the roads will stand. These batteries must be selected before the advance, the remainder being ordered to stand fast.

When the first rush is over, these latter batteries can be parked in suitable places and drafted forward as required and conditions permit.

The importance of highly organised railway work, with broad and narrow guage, came to light very forcibly at this time. The field

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artillery ammunition could be packed by horses; it was, at one time, a 15 mile pack to the guns. The heavy ammunition had to go by lorry with the exception of a few caterpillar trailers. Thus the rapid advance of the railway was essential, as the roads across the devastated area were not in a condition to permit of much lorry traffic.

It is of great assistance to traffic control, on single way roads such as the Bapaume—Albert Road was at that time, if long advances are made by "blocks". These "blocks" consist of several batteries of similar pace. The road is cleared for them so that they can run quickly through.

iii. It was found that some heavy artillery should form part of an advance guard of any size. Furthermore the moral effect of 8-inch howitzers and 6-inch guns, even used singly, was very great. It was well worth while to get single pieces of this nature forward, as it gave to the advanced troops a semblance of greater strength than they possessed; one of the most necessary functions of an advance guard.

iv. The principle of one artillery commander for all the artillery with a detached force such as an advanced guard, was clearly demonstrated. At the same time, he must be provided with an adequate staff from Division or Heavy Artillery resources.

v. The holding power of the machine gun in open warfare was early established. Attacks on villages failed because it was difficult to discover where the machine guns were located. Only very limited fronts could be effectively barraged with the result that the attack was stopped by some unbarraged machine gun.

The opinion was formed, which still held in 1918, that once a line of hostile machine guns has been established and it has been found impossible to turn this line, then it is necessary to wait, in order to collect adequate resources in guns and ammunition. To attack prematurely is to court disaster.

vi. As soon as the deployment began to take place against the the Hindenburg line, the importance of Corps control became at once apparent. It is essential that the heavy artillery Commander and Counter Battery Staff Officer should get well forward as soon as possible, in order to watch the situation, keep in touch, and be ready to take over at the earliest possible moment; otherwise the hostile artillery, in its carefully selected positions, may get a start which it will be costly to overtake.

vii. The importance of good co-operation between the infantry and artillery was of course manifest all the time especially in the attack of the villages, when the artillery needed information from every possible source in order to locate the hostile machine guns.

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The Battles of Arras and Vimy were carried out on Somme lines and caught the enemy in his old formation and adhering to 1916 tactics.

A very great point was made of counter battery work. The artillery intelligence was now a thoroughly going concern and the positions of the German artillery were very accurately known. The fire directed in accordance with this information was very successful in neutralising the German artillery. Subsequent examination of the battlefield revealed a very small percentage of errors in the hostile battery list. This was a matter which was continually improving and led to remarkable results in the summer of 1918. Some batteries on August 8th, 1918, were not even able to approach their guns after zero—the guns being captured with their muzzle covers still on.

The success of the battle of Arras and the German retirements further South brought us up against the Hindenburg system.

An examination of the portion captured at the battle of Arras and bombardment of the remainder disclosed the new arrangements of machine gun defence in depth. This was the first definite indication we had of any change in the German defensive tactics.

The advance from Arras, up against an organised position, had also got us into difficulties with the German artillery.

Counter battery work had now reached a stage when it was dependant on sound ranging, flash spotting and the artillery intelligence generally.

This was the first experience that these services had had of a considerable advance, with the result that they were all temporarily out of gear. Under these circumstances there is bound to be a difficult time from the counter battery point of view, but much was done before the end of the war to shorten this blind period.

Many large attacks were made at this time, which were successful at first, but by the evening our troops had been driven, by hostile counter attacks, from the ground gained in the morning. The attacks were supported by an adequate artillery and it was obvious that some very radical changes were required. The difficulty was, however, what to do.

You must remember that at this stage nothing much was known of the new German tactics except their desire for more open warfare and the machine gun defence in depth. This machine gun defence in depth led to protective barrages in depth, as it was found necessary to search the ground 2,000 yards beyond the final objective, in order to subdue indirect machine gun fire.

A small experimental tank attack was tried at this time in a place where the available artillery was inadequate for a barrage. The attack was made by 12 tanks and was successful at first; but eventually practically all the tanks succumbed to hostile artillery fire—foreshadowing, I think, the experience of 1918 when smoke for screening, and efficient counter battery work were found to be essential to a successful tank attack.

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The next event of 1917 was the Battle of Messines.

This battle is interesting on account of its early inception and careful preparations. Also for the first of the two big artillery duels ending in the defeat and retirement of the German Artillery. Co-operation with machine guns had greatly improved and the machine gun barrages were a feature of this battle.

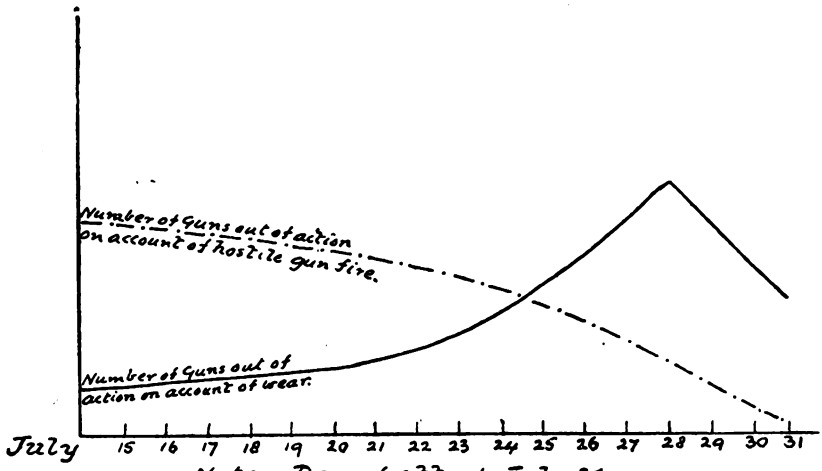
The attack was made with a limited objective and the German special counter attack divisions were not employed; so that no further developments in our tactics took place in this respect.

The next event was the battle of Flanders. This battle went on for several months without any pause in the fighting and was full of lessons.

The enemy had all the observation over the proposed battle ground. Few under features existed on our side of the line, so that flash cover practically did not exist. Cover from view was only provided by the somewhat rank vegetation in the hedgerows. The enemy's position was heavily wired.

A proposal was made to have a hurricane bombardment which in view of the enemy's superior artillery position was very attractive. The strength of the hostile wire however, made this proposal too risky an operation, so that preparations were made to cut the wire by gun fire, as was usual at that time. This automatically challenged the German artillery to the inevitable duel.

The hostile artillery had then to be subdued before the infantry attack could be launched. As many observed shoots as the weather permitted were made and large concentrations and area shoots were carried out. The latter were soon imitated by the enemy. For many days a ding dong fight was carried on without visible result on either side. Towards the end of the month the hostile fire slackened.



Note. Day of attack July 31

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The above graph was kept up from day to day, and illustrates the gradual subjection of the hostile artillery.

The two curves cross about July 25th. From that date the German artillery fire was very much less effective.

Towards the end of July the enemy evacuated, without orders, a large area of ground opposite the XIV British Corps, having been driven out by gun fire alone. An officer of the Prussian Guar captured at this time corroborated the curves of the above graph in his statements regarding the effect of the fire on the German artillery.

British counter battery work at this time was definitely superior to the German in the following two factors :—

i. Artillery Intelligence.

ii. Super heavy howitzers.

Information was now accurate and quick. The 12-inch howitzer was the best big howitzer on the Western front.

The barrage arrangements were much simplified looked at from the Somme point of view. We were no longer faced with deep highly organised trenches, so that it was unnecessary to pile up on the trenches; and generally speaking the barrage went straight across country.

The bombardment programmes were worked out in great detail. The matter was complicated by the fact that there was a good deal of hidden ground inthe foreground which had to be taken on with aeroplane observation. Consequently very nice arrangements were necessary in order to prevent batteries spoiling each other's observation by unauthorised shooting.

The long range guns were, throughout this battle, under Army control. They were used as a rule on definite offensive tasks immediately before or during a battle.

The tasks generally resolved themselves into long range bombardment of hutments and bivouacs ocupieed by reserve troops, or in forming a long range barrage to interfere with the movement of reserve troops or bus convoys. On battle days all the 6-inch guns and upwards were used on this latter task and it was sometimes possible to engage all avenues of approach.

All at first went well with the attack on July 31st. In the afternoon, however, we were driven back halfway to the starting line. The attack was renewed on August 15th with much the same results. Large advances to start with and little remaining at the end of the day.

There was fairly definite evidence that organised counter attacks, supported by fresh artillery, caused these retirements. This was a very different procedure to anything that had happened on the Somme.

Considerable changes were therefore necessary as the enemy succeeded in bringing fresh troops supported by fresh artillery against our infantry, weary after a long advance and either beyond or at very long range from their own artillery. Furthermore, there was a distressing paucity of dead Germans on July the 31st and the 15th of August, which pointed to the fact that the trenches had not been held

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very heavily. Every pill box had however its machine gun. We had thus practically got at the seat of the trouble when captured documents made everything clear.

The chief points in these documents are contained in the following extracts:

"In the case of the positions constructed hitherto with several continuous lines, the plan of the enemy is to destroy them at the beginning of a battle by the expenditure of great quantities of ammunition. The dug-outs situated in the old trenches were man traps and have often led to the loss of a large number of prisoners. These circumstances prove the weakness of the rigid methods of defence practised hitherto."

"The strength of the defence must lie in the concealment of our fighting force from the enemy's observation."

"As the destructive fire of the enemy proceeds the mass of the infantry is to be taken out of the forward trenches and dug-outs and to be echeloned in depth in the open before the first infantry attack."

Shell hole nests are to take the place of a trench line and are to be occupied by squads and single machine guns arranged chequer-wise over the area."

"A great part of the reserves and supports are to be accommodated in the open wherever cover from air observation exists.

"It is not sufficient that the infantry alone should be disposed in depth. The principles laid down must also be followed in the disposition of the artillery."

"The counter attack in depth pre-supposes that strong reserves of infantry have been stationed in the rear of the most important parts of the front, some 3 to 5 miles from the actual front line; a second line of artillery should also, if possible, have been organised from the mobile reserves of artillery."

"The situation, when the counter attack has been launched, can be summed up as follows:—

The enemy's artillery does not know exactly where its own infantry is, and is therefore obliged to exercise caution. On the other hand, our artillery fire is more effective.

It is noteworthy that the further the enemy penetrates into our position, the more favourable becomes the situation for the counter attack, as the enemy has not had time to consolidate the position."

It was proposed to deal with these points as follows:—

Holding the front system with machine guns.

It was decided to stop the trench bombardment as far as possible except where photographic evidence was available of actual occupation. The creation of a mass of shell holes was only playing the enemy's game.

Furthermore it was decided to make considerable alterations in the attack barrage. It was our experience at this time that the enemy's artillery was only dangerous on battle days when—

i. Troops were forming up.

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ii. During a long halt on subsidiary objective when the enemy had time to find out where our infantry were.

iii. When we had reached and settled down on our final objective.

The enemy's machine guns had, on the other hand, increased and attacks had failed on account of long range machine gun fire from the flanks as well as from behind the objective. A large portion of the counter battery artillery was therefore brought into the barrage from about zero + 15′ and kept there as long as the infantry were in movement. Four seperate barrages were formed and all except the 18-pounder creeper jumped about in an uncertain manner so as to mystify the enemy and catch him unawares.

Withdrawal of the garrison—the enemy could count at this time on our taking anything up to three hours to reach an objective 2,000 yards deep. The enemy had thus 2 hours to move up for a counter attack. He might do 4 miles in this time. Therefore the hostile garrisons might be living 9,000 yards from our front line. It was decided to bombard, before the next attack, all places at long range which gave cover from aeroplane observation.

The counter attack by fresh hostile troops.

This was the crux of the whole matter, and it was hoped that the alterations in bombardment would have shaken up their moral.

The enemy counter attack was as much a set piece as our attack and set in motion by our zero hour. We could therefore lay for it.

The conditions required to defeat these counter attacks were :—

i. The full force of our artillery must be available in positions from which it has been carefully registered.

ii. Our infantry must be well in hand and organised for defence in depth.

These conditions are fulfilled if the first objective is within 1,000 yards of our starting line. The objective must be one that the enemy would want to take back and one that our infantry could reach in good order. Good observation facilities were also desirable.

It was our intention to wait on this position and fight the enemy on ground of our choosing.

It was possible to prepare a second or third objective to be carried out if the enemy was thoroughly defeated. His approach march was to be attacked by the heaviest possible fire, and positions of deployment well searched.

The battles of September 20th and 26th were fought on these lines, being preceded by a 24 hour and 2 hour bombardment respectively and were very successful, everything working out as expected.

October 2nd was fought on the same lines, but was not so successful.

It had been already appreciated that if the new arrangements made for September 20th were successful, then the enemy would have only two courses open to him, viz :—

i. To bivouac his counter attack division out of our range.

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ii. To return to the Somme tactics.

The first alterative would make these divisions too late to intervene successfully in the battle. The second would again bring the German infantry under the full force of our artillery.

On October 2nd he appeared to have chosen the second alternative. A captured document stated :—

"Frequently the counter attack barely reached the line still held by us, suffered heavy losses and was quite fruitless, as the enemy contented himself with the objective gained. Experience shows therefore the necessity of holding the front line in strength."

We then returned to the Somme tactics and bombarded the forward area. The whole area was raked and swept in all directions. The appalling conditions of the ground made movement almost impossible to the infantry so that little advance could be made.

Nevertheless the enemy was again forced to change his tactics and made arrangements to put a dense machine gun barrage along the whole front. The idea was to hold up our attacks and delay our defensive arrangements, so as to expose our troops to hostile barrage fire and the attack of the local reserves. The enemy had definitely given up any idea of moving up counter attack divisions. He succeeded in producing machine gun fire of extraordinary violence, which stopped one attack. Our answer was to bring more guns into the barrage from counter battery work and this particular trouble disappeared.

By the end of October the enemy had again reverted to holding the outpost system with posts arranged chequerwise and keeping the reserve battalions behind his main line of resistance into which they moved when an attack started. He also at this time made his most effective move. On a code word (which was sent on a large attack being anticipated) the forward lines withdrew at an ordered hour within the outpost line of resistance. Fifteen minutes after this hour, or after our zero if it came before, the defensive barrage was placed on the enemy outpost line. This brought it down East of our leading wave, even if the hostile barrage was five minutes late. Our troops had then to pass through this, and attack the outpost line of resistance. The occupants of this line retired after fighting to the main line of resistance. A light signal was then sent up by the company commander in the main line of resistance and the hostile barrage was brought back to close in front of it.

Mud prevented the real testing of these tactics. In principle they are the same as those adopted by General Gouraud south of Rheims in 1918.

No satisfactory solution was found in 1917. The matter will be left here for the time being, as the whole question of defence is discussed in Chapter V.

The battle of Cambrai at the end of 1917 is one of the tactical

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landmarks of the war, for the following reasons :—

i. Strategical surprise was made possible by the ability of the tank to attack a wired position without previous preparation.
ii. An accurate barrage was fired without previous registration.
iii. Secrecy in preparation and concentration was achieved and a tactical surprise obtained thereby.

These three points all contain the element of surprise which is perhaps the chief essential to obtain a tactical success; and from this time forward, surprise or deception in some form or another was present in all the major operations of the war.

Surprise and deception had really been the keynote of most of our successful artillery manœuvres up to the time of Cambrai.

The universal publicity, long before the event, of our attack in Flanders, made apparent the absolute necessity of safe-guarding the secrecy of intended operations.

Various measures to obtain this result were therefore introduced. The success of Cambrai was the first reward of these changes.

The attack on Lens in the Autumn of 1917 provides a useful lesson, as it was made chiefly under machine gun barrages. The lesson being, that provided sufficient fire power is developed the relative numbers of guns, machine guns, etc., does not materially matter. Therefore start your problem by deciding what volume of fire you require. Then build it up from your resources.

The principal lessons learnt during the Summer and Autumn of 1917 may be summarised as follows :—

i. The rate of advance of an Army is entirely governed by the pace at which a sufficient supply of guns and an adequate supply of ammunition can be got forward.
So long as the enemy has a portion of stout hearted machine gunners and a supply of entrenching tools, so long will it be necessary for us to make use of large concentrations of artillery in supporting our infantry. Always provided that other means of overcoming the machine gun, which were not invented or obtainable in 1917, are not available.
ii. The value of surprise—Compare the heavy fighting on July the 31st at Ypres with Cambrai. The tactical surprise of September 20th was immediately successful where similar force but different methods had failed previously.
iii. Adaptability and versatility are essential to successful tactics. The data for these changes must sometimes be obtained by fighting but much can be done if the operations and intelligence branches of the Staff really get together and constantly appreciate the situation, putting themselves in the enemy's position and using their imagination.
iv. The power of the machine gun both in attack and defence was further exemplified. Its power must be neutralised at all costs in order to bring off a successful attack.

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v. To destroy the hostile artillery takes time and organisation. Given this and the necessary strength, it is not necessary to worry about the hostile artillery on battle days. When previous firing does not take place as on August 8th 1918, the situation is, of course, entirely changed.
Success is then achieved by accurate information obtained before the battle, combined with an overwhelming volume of fire at zero.
Gas shelling definitely took its place in counter battery work this year. The enemy were still ahead of us in the volume of this fire, which he produced, and in the possession of mustard gas. His use of the latter gas, in 1917, foreshadowed the tactics he employed in 1918, in forbidding the use of certain areas to artillery altogether, by means of mustard gas.

vi. The unregistered barrage after 1917 became the normal procedure and in 1918 became very accurate. Unregistered barrages had been suggested before Cambrai 1917, but the state of training of the artillery generally, was not such as to warrant its use before this date.
Unregistered barrages naturally require to be simple in their conception. The infantry learnt in 1918 to give way, so that some feature marked on the map, such as a road, could form the opening barrage line. The barrage then dwelt on this line to allow the infantry time to close up to it before actually commencing the attack.

vii. Pace is an important factor in all attacks and should be as fast as possible consistant with keeping up with the barrage. Anything slower than 100 yards in 6 minutes precludes the possibility of a successful attack under ordinary circumstances.

viii. Ammunition expenditure showed the same tendency to increase as in 1916. Nevertheless the replacement of guns was now a much more difficult matter than the provision of ammunition. In this connection it is nearly always parts and spares, for which insufficient provision is made, and the present abundance of material should enable us to set up sufficiently generous standards for mobilisation, in order to stand the strain of the first weeks of the next war.

ix. The use of long range artillery was more understood and had been brought definitely to help towards the immediate tactical objective.

x. "Stunts" for lack of a better word, are invaluable but they must be continually revised else they fail to act.

xi. Battle harassing fire had defeated the German counter attack divisions, and had come to stay in the tactical repertoire.

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xii. Close co-operation between machine guns and artillery had been shown to be essential to efficiency.

xiii. The railway work had grown out of all recognition. Masses of artillery can really only be kept in action by light railways and therefore, these two subjects must be considered side by side when plans for operations are drawn up These railways must usually be laid to suit artillery requirements and adapted for other purposes, as over 90 per cent of their tonnage is ammunition.

A great danger lies in searching out the "lessons" of any operation, in that an attempt may be made to apply these lessons under altered circumstances. The principle only, is of general application; not the method.

Thus the form of the barrage, its density, its composition, etc., is nothing. It conformed to certain evolutions on the Somme. At Ypres it was entirely different, even at various stages of the battle. At Cambrai it was different again. In each case, however, the hostile machine gun fire was sufficiently subdued to enable the infantry to advance.

Therefore each case must be considered on its own merits; the various solutions in the past, dealt with in these chapters, being only an assistance in formulating plans for the future.

CHAPTER V. 1918.

The strategical situation at the beginning of 1918 was such as to cause a complete change in the tactical train of thought of both sides.

Both sides had become specialists, we in attack and the Germans in defence. During the Winter the enemy studied the offensive and trained for the Spring attacks. We commenced to study seriously the defensive.

We both very shortly had an opportunity of testing our opponent's tactical theories in the fighting which took place in March and April 1918. Several points came up during this fighting, which led to a great deal of discussion during the year.

We are a conservative people and usually give way to innovations only when compelled by the force of circumstances. In the old days the young advocates of the new fangled muskets referred to their senior officers as bow and arrow Generals. To-day the Tank and Machine Gun Corps look upon the rest of the Army in much the same light and yet we remain unmoved! So that in the course of a single Summer it is not to be expected that any radical changes would be made.

Before considering the changes which might have been made, it is necessary to visualize the conditions under which defensive battles, like those in the beginning of 1918, are usually fought.

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These are—

i. An almost certain numerical inferiority in guns.
This precludes the dense S.O.S. protective barrages fired in 1916 and 1917 when the 18-pounders were 15 to 25 yards apart. Under defensive conditions there will usually be 100 to 200 yards to each 18-pounder gun.

ii. Uncertainty of the point of attack. Although the Germans in March 1918 did not attack with tanks, our wire was not of sufficient density to necessitate any preliminary cutting. Consequently the strength of guns in action had to be further reduced to provide the essential reserves of artillery.

These reserves, with those of the other arms, will eventually stabilize the battle; but they will not prevent the enemy's initial success. The cost of this initial success to the defender will depend on the relative strength of the opposing forces. Consequently, the greater the disparity in strength between the two sides, the greater will be the proportion of troops to be held in reserve by the defence.

The tactical duties to be undertaken by the artillery under these conditions are :—

i. Offensive fire action against the enemy's infantry and artillery during their approach marches, assembly and deployment.

ii. To assist the other arms to defeat the enemy's infantry in their actual assault.

In order to carry out the second duty, the artillery must be disposed in depth behind the battle position, since a successful assault of the front edge of the battle position would otherwise, either entail the capture of all the defending artillery, or cause a large portion of it to be in movement at the most critical period of the battle.

Furthermore in 1918, from the artillery point of view, the front edge of the battle position could not be more than 2,000 yards from our own front line; otherwise the defence had to choose between two alternatives :—

i. Inability to reach the enemy with field gun fire during his assembly.

ii. Reduction of the depth behind the battle position since, in order to reach the enemy's assembly, a portion of the guns must be placed in the outpost zone.

This distance of 2,000 yards also fulfilled the condition that the battle position should be free from the enemy's mortar bombardment.

The same principle holds good to-day—the ranges depending on the equipments in use by ourselves and the enemy. The following diagram of a theoretical defensive position illustrates the above points :

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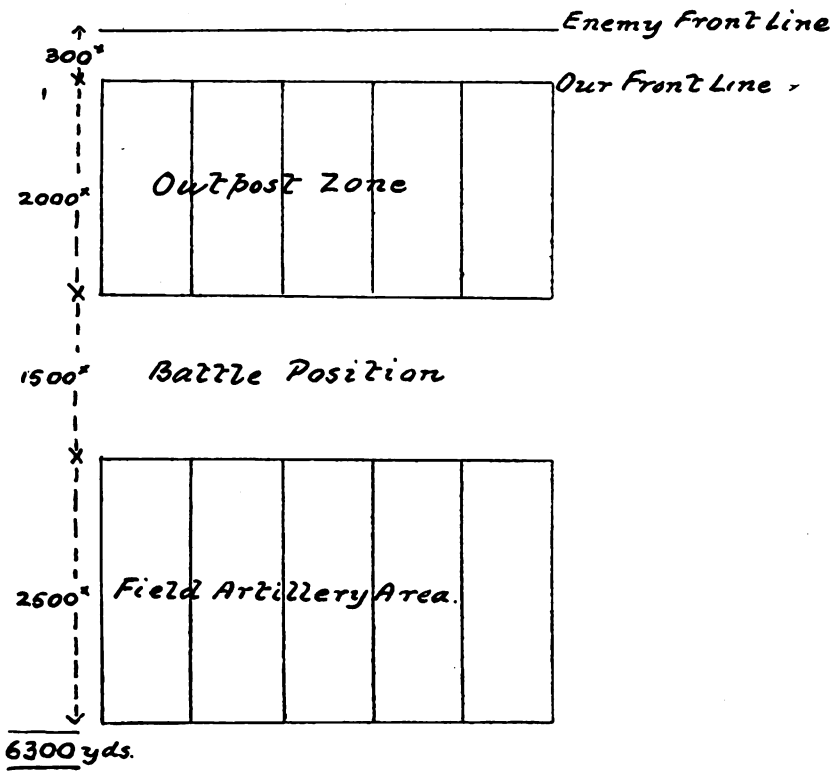

Under certain conditions the outpost zone may be eliminated altogether, in which case the disposition and tasks of the artillery become simpler. The value of the ground either tactically, politically, commercially or morally will normally decide the depth of the outpost zone, up to the artillery tactical limit.

Successful instances of both extremes can be quoted from 1918. In April, the I. Corps defended the front line at Givenchy; in July General Gourod, South of Rheims, had an outpost zone of great depth. The Allied victory gained in this latter battle proved to be the high water mark of the German successes in 1918.

When the battle position is withdrawn from the front line and an outpost zone exists, two courses of procedure are open to the commander.

He may—

i. Dispute every yard of the outpost zone to the utmost limit of the troops detailed to hold it.

ii. Withdraw all troops from the outpost zone before the hostile infantry attack, leaving it open for an offensive fire fight against the attacking infantry.

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In both cases the main fight will be made on the battle position, but the artillery can be much more helpful in the second alternative than in the first.

As regards the three points already mentioned :—The first one I want to discuss is the utility of the defensive barrage.

Our own experience in 1916 and 1917 had been that the leading waves invariably escaped the hostile defensive barrage unless the actual moment of attack had, in some way, been made apparent to the enemy.

A fixed defensive barrage, such as was used at that time, then became thin on account of counter battery work or some such reason; and disclosed avenues through which the supports could advance.

The German manœuvre at the end of 1917, in bringing back his defensive barrage in front of our leading attacking waves, deprived these troops of the advantage they had gained by making a surprise attack and forced them to go through the hostile barrage.

No satisfactory antidote to these tactics had been found by the end of the Flanders Battle.

One disadvantage in this procedure is that the moral effect of giving up ground without fighting may be bad. This is probably a matter of education as it is really a question of the manner of your fighting rather than of not fighting. If the infantry soldier understands that the outposts are there purely for observation and repelling patrols, and that the guns and machine guns will attack the enemy with fire before the latter attack him; then it would be seen that his moral would be raised rather than lowered.

A combination of the two methods is possible if fixed redoubts are held in the outpost zone and the barrage is brought back round these redoubts or even behind them in such a manner that the redoubt themselves are free from fire.

This has the advantage of breaking up the infantry attack by rifle and machine gun fire in the outpost zone, as well as forcing his leading waves to pass through our barrage.

In the case when the infantry are ordered to dispute every yard of the outpost zone; the mass of the defensive artillery fire must lie wholly outside this zone; since the incidents of the fight will cause our infantry to be scattered throughout the whole zone. Therefore, unless the outpost zone is definitely evacuated, either wholly or in part, by our infantry; it must be accepted as a basic fact, that the leading attacking troops can always escape the defensive barrage. These troops must therefore always be dealt with by the infantry themselves, assisted by the small amount of observed fire possible (from guns) under the smoke and dust of the hostile attack barrage.

The next point I wish to consider is the relation existing between counter-preparation, the defence barrage and the S.O.S. By counter-preparation I mean fire action against the enemy during his approach march—and assembly or deployment. By defence barrage I mean the intense fire opened at the moment of the hostile infantry attack.

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The S.O.S. should mean the same as the defence barrage, but is humanly bound to be associated with a large proportion of false alarms. In France it was also an indirect order to the artillery to fire on the defensive barrage lines; although the signal itself only meant that the infantry was attacking.

Now the defence barrage must be very closely associated with the defensive machine gun fire. The number of guns at the disposal of troops on the defensive will rarely permit of a thick barrage along the whole front. A thin barrage is worse than useless as it can be passed anywhere—this is undoubtedly so and, I think, is generally accepted.

Therefore the correct procedure is to allot certain portions of the front to guns and certain portions to machine guns when your available resources will probably permit of both Arms concentrating their lines of fire to an effective density.

The defence barrage was usually placed as close as safety conditions permitted, in front of our most advanced infantry, in the hope that it might catch the enemy leading attacking troops. As has been shown above, this was a hope that could rarely be fulfilled.

Now the Artillery tactics before the hostile infantry assault must be offensive, if anything is to be achieved. These tactics consist of firstly :—

i. Harassing fire at long range against the enemy's routes of approach.

ii. Counter battery work in suspected battery areas to destroy equipment and ammunition.

Secondly :—

i. The attack of the hostile infantry assembly during the last few hours before zero.

As things were in 1918, this attack of the assembling hostile infantry, which, when we were attacking, was always the great fear present in everybody's mind on Y/Z nights, could be stopped at any moment by the premature use of the S.O.S. signal. Most of the artillery fire was then automatically taken from offensive action against the enemy's infantry to ploughing up an empty 'No Man's Land'.

The S.O.S. is very catching at a moment of strain and one signal will be repeated all along the line; it will run across a battle front of 10 or 12 miles in a few minutes.

Also this signal is just as likely to be sent up 5 hours before the real attack as 5 minutes, and, in fact, in practice this has occured.

It is therefore capable of completely nullifying any counter preparation plans or programmes, which the Commander may prepare.

On the offensive the S.O.S. was most effective in dealing with counter attacks.

On the defensive, it is entirely out of place except in those isolated instances when the moral of the infantry is such that they require to hear our shell bursting just in front of them.

Even so, since the main fight will be made by other infantry held

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back on the battle position, it is contended that more good will be achieved in the long run by attacking the moral of the hostile infantry rather than in any attempt to bolster up the moral of the front line outpost infantry who, after all, have only been allotted a subsidiary role in the battle.

This matter was being discussed throughout the Summer of 1918, and the following solution was advocated.

The S.O.S. to be an information signal only; meaning that the hostile infantry are attacking, but not automatically entailing any immediate action by the artillery. On receipt of the S.O.S., fire would be turned on by the artillery sector Commander as required. In battle, counter preparation was not to be changed to barrage fire until orders were received from the rear. The rear Commander, of course, being guided by the reports and signals received from the front line and by his own tactical knowledge.

He, of course, will have to be well up in a command post and will give his orders by wireless or light signal. Counter preparation to be carried out by intense surprise bursts of all natures jumping about the probable assembly areas.

Barrage fire to be made as thick as possible by including all available guns of every nature.

The theory of these tactics is as follows :—

i. The leading hostile infantry cannot be attacked with artillery fire immediately after zero unless the barrage is brought back. If this is not done, they must be left to the machine guns, Lewis guns, rifles, and counter attacks by the infantry. At any rate, artillery fire is not wasted in abortive attempts to damage the leading hostile infantry.

ii. The weak spot of all attacks i.e. the assembly, is attacked in full strength right up to zero; as barrage fire will not be ordered till it is certain that the attack has taken place.

iii. The barrage fire, when put down, will be sufficiently thick to hinder the advance of supports, and the passage of runners back with information regarding any "soft spots" found by the attackers.

The third point I want to discuss is the control of the barrage fire after zero or after it has been put down. That is to say, when it is to be brought back and by whose orders, omitting, of course, the case when you bring it back as part of your plan i.e. the second alternative.

We have the choice of bringing it back in sections of increasing size by the orders of Brigade, Divisional or Corps Commanders or even of leaving it where it is until such time as our guns are forced to retire by the advance of the enemy's infantry.

The chief difficulty encountered is the total lack of accurate and timely information.

It is usually not known for hours after the event, that a certain line has been captured by the enemy.

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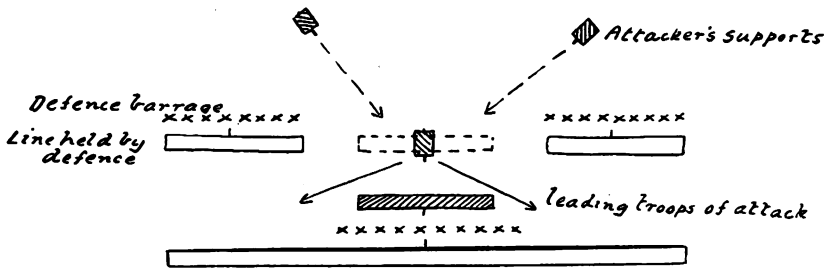
Any attempt to order back the fire in sectors according to the progress made by the enemy in his attack, is therefore quite useless.

Furthermore, if the fire is brought back in small sectors, it merely indicates the "soft spots" in our defence to the hostile supports.

Examine the two diagrams.

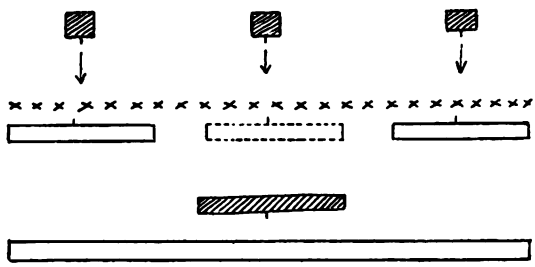
I.

The barrage brought back in Sectors.



II.

The barrage maintained intact.



The defensive barrage should therefore not be put down until it is certain that the hostile infantry attack has commenced.

It should then contain all the guns available so that your full strength may be used against a target which it is possible to damage, viz :—the hostile supports.

The barrage must make up for its comparative weakness by mobility, and work by heavy bursts of fire in ordered areas.

It may thus hinder the advance of the supports and generally dislocate the enemy's attack.

The leading hostile troops will not be strong enough to exploit, without supports, any successes they may gain, and should thus fall an easy prey to our counter attack in the battle position.

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Nothing in the above, will, of course, be allowed to prevent batteries engaging hostile infantry with observed fire whenever opportunity offers. Under battle conditions these opportunities rarely occur and still more rarely can be taken advantage of, so that guns, temporarily removed from the barrage for this purpose will not seriously affect it.

The chief innovations made by the enemy in his attacks were :—

i. The movement of so many divisions, one behind the other. We had never dared to be so prodigal of troops or attempted to pass divisions through in the way he did.

ii. The enveloping nature of his infantry tactics, and the choice of certain routes of advance, and neglect of less favourable ones.

iii. The unregistered hurricane bombardment in an attack, against a wired position, without tanks.

iv. The control of the attack barrage from the firing line.

It is only the last two that concern us at the moment.

The surprise unregistered barrage dated from Cambrai and was carefully practised all the Winter of 1917/18 at the German Practice Camps. His choice of this line of action was tactically sound. It offered the great advantage of surprise, and our wire was such that almost any bombardment with instantaneous fuzes, would have made passible for infantry.

We learnt, however, at Arras and other places, that an attack barrage cannot be depended on to cut the wire on rear lines; if it has been constructed in the strength usually employed by the Germans.

The success of this attack does not, therefore, invalidate the statement that an attack, without tanks, cannot be made against a wired position, after a hurricane bombardment only.

The German orders for the attack in March 1918, made an attempt to control the attack barrage by the leading attacking troops themselves.

Our experience in 1916 and 1917 was that an attack barrage must be fired throughout its programme for the following reasons :—

i. The information on which any changes might be based, did not usually arrive in time for action to be taken.

ii. In those cases where information did arrive in time, it was considered to be sounder to allow all troops to go on as far as possible, in order that those who were successful might outflank such of the enemy, as were still making a local resistance. The danger in bringing back any fire, being, that successful troops might be stopped by this fire or even destroyed by it.

The German idea was somewhat different as it was an attempt at the ideal, i.e. the control over the exact front required by the people who were acting in co-operation with the fire.

We have no evidence that it was successful and we do know that the Germans were dissatisfied with their barrage arrangements in the

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Spring of 1918. We therefore retained our previous methods in our attacks in 1918.

The communications available in 1918 made the German ideal an impracticable proposition. Neither do the advances made up to date warrant its introduction. The complications involved rule it out on the axiom of simplicity.

We now come to the consideration of our own attacks in 1918.

We will consider these under four headings.

i. Preliminary arrangements.
ii. Bombardments.
iii. Barrages.
iv. Pursuit.

The attacks are, of course, very full of lessons for the student, but do not show any great development in our tactics. The tank was still a comparatively new arm, and had not had time, as yet, to materially affect tactics.

The preliminary arrangements were kept secret. This had the added advantage that no bombardment was necessary. This automatically reduced the quantity of ammunition required and did away with the necessity for elaborate protection for both guns and signals.

Accurate map boards and careful resections of large numbers of battery positions made a heavy demand on the field survey battalions.

Great care had to be taken to conceal the dumping of the ammunition required for Z day. Careful arrangements had to be made for the assembly of the batteries and for the concealment of wagons lines, watering points, etc.; and for the artillery deployment at night.

It was found advisable to finish as much of this artillery deployment as possible by X/Y night, so as to save congestion on Y/Z night.

A great point was made of early issue of orders and no changes being allowed once decisions had been made.

As explained in previous chapters, the infantry were now prepared to give way as regards their starting lines for the attack, thus enabling barrages to be much simplified.

The artillery, on the other hand, allowed the infantry time to close up to the barrage before the actual commencement of the attack. The actual barrage then went through as before.

Simplicity in tactics means speed in preparation, and usually efficiency in execution, and is therefore essential for open fighting. H.E. with 106 fuze for 18-pounders was much used for the same reasons.

It was found that bombardments were necessary before the subsequent attacks of any particular battle i.e. when strategical surprise was no longer possible.

No wire had to be cut as a rule, as the tanks did this; but it was necessary to cover the between-battle counter battery work and to lower the moral of the enemy.

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In certain cases 48 hours bombardments took place, including periods of intensive counter battery work and special gas programmes.

Barrages were fired in depth. Tanks helped with machine guns so that guns were released for counter battery work. This is, of course, essential when the hostile artillery has not been knocked about by previous counter battery work. Special counter battery work is also required for the protection of the tanks.

In some battles as much as 60% of the available heavy artillery was employed on counter battery work during the barrage. Smoke was often used in large quantities, partly to blind machine guns and partly to protect the tanks from anti-tank guns.

It was found, however, that the smoke tended to blind the counter battery aeroplanes so that it interfered, at times seriously, with the counter battery work, and also with the work of any planes detailed to observe the enemy's movements.

Smoke is, therefore, a matter to be carefully watched.

In examining the arrangements made towards the end of 1918 we must always bear in mind that the moral and fighting value of the enemy was rapidly declining, and therefore lessons deduced from these operations might lead us into trouble at the commencement of another war, when the same risks could not be taken with impunity.

The lessons of the Pursuit do not differ materially from those of 1917, except that these operations provide many examples to be copied.

We find that machine guns still cause the deployment of large numbers of guns, and the dumping of large quantities of ammunition, before it becomes necessary for the machine guns to withdraw.

Our advance is therefore dependant on road and railway construction; and careful staff work is necessary to control the assembly, advance, and deployment of the masses of artillery material required. This increases as the advance continues and we become dependant on long narrow lines of communication.

Where had we arrived then, by the end of 1918? The following points, I think, stand out :—

i. *The study of the ground.*

This is the basis of all tactics. The massed attacks of previous years had rather obscured its importance. In 1918 we returned to the study of the ground and our main efforts were made in those localities where the ground favoured us; the intervals being observed and concealed by gun fire. In the future this will be equally important.

ii. *Fire must be met by fire* and movement is only possible when fire superiority has been obtained.

The machine gun remained undefeated by the artillery to the end of the war, regarded in the light of comparative expenditure of effort. Nevertheless, the artillery remains, at present, the only arm capable of neutralising the machine gun. Therefore an attacker must still outflank an enemy

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and so cause him to retire; or have sufficient artillery to neutralise the hostile machine gun fire.

iii. *Counter battery work* has become essential in all actions. We have seen the stabilising effect of artillery fire on infantry continually on the increase throughout the years previous to the Great War, and especially since 1904. Innumerable instances can be quoted from every theatre of war where attacks have been squashed at their outset by a comparatively small number of guns. Therefore, if we hope to win battles with infantry, we must be able to neutralise the hostile artillery. This problem, as regards open warfare, had not been solved by the end of 1918.

iv. *The campaign of 1919* would have initiated what might almost be called a new era in tactics owing to :—

(a) The improvements in actual battle co-operation by the Royal Air Force.
(b) The introduction of large masses of tanks.
(c) The improvements in all forms of communication.
(d) The increase in mobility owing to cross country traction.

Lacking the impetus of war, the above items will all need several years of development in peace-time, before they can seriously affect the tactical balance of 1918.

Nevertheless, these innovations would appear to contain the means of overcoming the difficulties left us in 1918, viz :—

(a) The fire power of the machine gun on the defensive.
(b) The immobilisation of the attack by gun fire.

Put shortly, the Royal Air Force may be expected to develop further efficiency both in close support of the actual attack and in counter battery work. The tank may be expected to close with the defence and release guns for counter battery work.

Wireless telegraphy in its future form, and wireless telephony, go a long way towards the effective neutralisation of the hostile artillery.

Cross country traction, once it is available in large quantities, frees an army from its roads and makes possible the quick massing of guns and ammunition.

This subject is, however, beyond the scope of the present paper and may therefore appropriately be left at this point.

In conclusion I should like to refer again to a few of the main points, underlying successful artillery tactics during the late war, since these must form the basis from which the artillery tactics of the future must evolve.

i. A good knowledge of the organisation, capabilities and limitations of our various equipments, and their means of traction, both in marching and fighting, is required.

The same applies to the various services auxiliary to the

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actual guns, Royal Air Force, observation groups, sound ranging sections, balloons, etc.

ii. The organisation, equipment and tactics of the enemy, especially as regards the employment of his machine guns and infantry reserves, must be closely studied.

iii. Every new invention to improve the efficiency of the artillery must be siezed upon and tactics evolved, to obtain the maximum value from it.

iv. In addition to the above, it is necessary in the Field, to continually investigate the reason of things, and to combine this with clear and logical thought.

The enemy's movements and intentions are thereby made apparent, and tactical surprise then becomes possible for the attacker.

A Commander will thus be in the position to obtain the maximum value from the force of artillery placed at his disposal.

CONCLUSION.

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THE TRAINING OF THE NON-COMMISSIONED OFFICERS OF THE ARTILLERY FOR WAR.

(Summary.)

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

General Leutnant von Hippel has two articles in the "Militar Wochenblatt" Nos. 1 and 2, 1920, under the above title.

He remarks that, before the War, infantry and cavalry N.C.O's were carefully trained as leaders of small detachments of their arm in the solution of problems. The training of the artillery N.C.O. on the other hand, was limited to despatch-riding and riding drill; his training as the leader of his sub-section outside the battery formation was neglected. He only commanded his sub-section so far as interior economy was concerned. Most N.C.O's had an opportunity once or twice a year to fire a few live rounds on the manœuvre ground, usually from a gun already unlimbered and in action. A little drill of a similar nature was done in the garrisons. That was all. The allowance of ammunition in peace-time was such as to suffice for the advanced training of group and battery-commanders and the senior subalterns. This advanced training was greatly helped on by increased attachments to the gunnery school. This training should not be reduced. The tactics of batteries and larger formations retain their importance. On the other hand the importance of the single gun in action has increased. The partial or entire breaking up of accompanying batteries into sub-sections during an attack, the employment of single guns at suitable points in a defensive position, their activities in retreat, their attachment to small parties with special missions, even on outpost duty, will often be necessary.

Even in the long stationary front, the situation often required the employment, permanently, or more often temporarily, of single guns at certain spots, sometimes in neighbouring divisional areas. While the battery leader or a qualified officer might often be able to control the fire, or at least the "shooting in", and often the best layer might be quite equal to carrying out the task allotted to the gun, yet the mere fact of the independent employment of the gun made the thorough training of its commander imperative. The battery commander cannot be everywhere. Fleeting opportunities can only be taken advantage of by the leader on the spot. He must be equal to them.

The 1914 regulations for Field Artillery were written for the battery and higher formations. "The battery must have the pliability of a single weapon in the hand of its leader." This must not be altered. As many N.C.O's as possible were to be trained in shooting a gun and given frequent opportunity to observe. But there was no tactical training and the technical side was incomplete. From war

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experience, it is necessary to train all N.C.O's in the independent execution of tasks, especially with percussion shell. Before the war, we frequently did not sufficiently value the accurate percussion shell. The time fuze occupied our attention excessively.

This training in shooting with a single gun must be done chiefly in the garrison, away from the manœuvre ground and ranges. As with the Infantry, shooting must be a leading item of training throughout the year. Only so can one count on well trained troops. Shooting can be carried out in the garrison, since shells can be made, which do not break up and are therefore harmless beyond their point of impact. These were used for heavy howitzers before the war, and the shell cases could be used again. Expense has to be considered. With such projectiles, one can shoot, even in thickly populated districts, without closing large areas.

In the earlier stages, any object on the drill ground may be taken as target to practise gun drill without actually shooting. Later a genuine target is advisable in order to encourage the love of shooting.

The expenditure of ammunition for a practice shoot can be quite small. Expenditure of ammunition to correct an error is usually waste; it is more to the point to make the error clear by explanation and practice without ammunition. Naturally, the task set must be simple, but there should be real practical exercises; thus for direct fire they should usually be given when the gun is limbered up and away from its position. The man who is shooting must be given time to consider everything in order to reduce as far as possible the time from the appearance of the gun under enemy fire to the first round. Surprise targets will be given later. Numerous tasks with open sights, for most of which few rounds suffice, must be the basis of this training. They increase self-confidence and interest in the work. N.C.O's will soon be discovered who are quite qualified to carry out simple tasks from covered positions. In these it is at first advisable to arrange for the leader to communicate with his gun by word of mouth. Frequently the necessary basis for the exercise will be given by imagining an attack against a strong front with accompanying guns. When some proficiency has been attained, the presence of small infantry detachments will increase the interest and promote mutual understanding between the arms.

The training of the N.C.O's in the use of time fuzes is a secondary consideration; it is also more costly and not always possible in garrisons without enclosing large areas.

The present long period of service offers full opportunity to carry out training on the lines indicated.

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"DUNCAN" GOLD MEDAL ESSAY, 1921-22.

Deduce from the experience of War, the future of the defence of Coast Fortresses against Attacks by land, sea, and air, during the next ten years.

BY MAJOR & BT. LT.-COL. F. W. BARRON, O.B.E., R.G.A.

"Si Vis Pacem, Para Bellum."

IN these days of financial stringency, when the cry for economy is upon the lips of every "man in the street", it is, perhaps, only to be expected that our coast fortresses should be a target for the axe of the economist; the more so, seeing that, during the whole course of the greatest war in the history of Great Britain, there is no single instance of a serious attack by the enemy on any of our great defended ports. The fact that the efficiency of the defences of those ports was, of itself, a reason for the absence of attack, is either unknown to, or deliberately ignored by, those who maintain that coast defences are nothing but a costly encumbrance. And yet these same people would hardly suggest that the Bank of England should be left unguarded, or rest confident in the protection to their houses afforded by locked doors and windows, and therefore vote for the abolition of the Police. That coast defence will be necessary in the future as in the past is beyond doubt. Our problem in this paper is to consider the form which such defence must assume, and in what respects it will differ from the coast defence of pre-war days.

CHAPTER I.

It is to be noted that the period of time to be covered in the forecast in this paper is to be one of ten years. Since the subject was selected, however, two important things have occurred :—

(a) It has been decided by the government that a war against a civilized power may be treated as in the last degree improbable during the next ten years.

(b) At the Washington Conference we have definitely abandoned our position of maritime superiority, and have adopted a "one-power standard", which is to be maintained, again, for a period of ten years.

Consequently we are dealing with a period during which we regard war as improbable, and when, should the unexpected happen, we shall be relatively weaker than ever before, as regards our navy.

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It is to be feared that the opponents of coast defence will be encouraged to even greater activity by the former factor, and will fail to observe that the existence of the latter only renders it more necessary than ever for us to ensure adequate defence for our more important naval bases and sea-ports.

Let us therefore consider for a moment what is the object of a coast fortress, i.e., the rôle it is intended to play in war.

It cannot be doubted that to the uninitiated, the word "Fortress" only too often conveys the same meaning as the word "Fort". It calls to mind an impregnable citadel such as Kronstadt, or a fortified island fastness such as Heligoland. The expression "Coast Fortress", however, covers an idea far more extensive than this. It is difficult, if not impossible, to give an exact definition, but perhaps a suitable description would be :—"A coast fortress is a locality containing works of defence for the purpose of repelling attack by either air ,sea, or land, with the object of safeguarding some important military or civil establishments located within its perimeter". It will be seen that the definition covers every kind of defended locality, from the smallest coaling station up to an enormous area such as that of the Portsmouth Defences, which includes the whole of the Isle of Wight. It will also be apparent that the definition will include not only those localities which exist as coast fortresses in time of peace, whose defences have been gradually developed, extended, or improved in conformity with the progress of scientific and mechanical knowledge, but also localities which may be converted into coast fortresses in time of war. (For examples of the latter we may point to Scapa Flow and Zeebrugge, which were converted into coast fortresses during the recent war, the former as the base for the British Grand Fleet and the latter as an advanced base for German submarines).

As regards the rôle of the coast fortresses, it is merely stating a platitude to say that the only means to final success in war is to attack, and it may therefore be argued that to spend money on a purely defensive article is simply to divert that money from the more profitable purchase of instruments of offence. This is certainly true, within limits. But weapons of attack require renewal and repair, schemes of attack entail provision of food, ammunition, and a host of stores of all descriptions, and finally, the direction of attack calls for the provision of Staffs, Intelligence centres, and numerous establishments of personnel. And all these varying factors demand security as a condition of complete efficiency. The rôle of the coast fortress, therefore, is to provide that security for the direction of attack, and for the preparation, supply, and maintenance of the means thereto, both in personnel and material.

CHAPTER II.

PRE-WAR CONDITIONS.

It has always been taken as an axiom that our naval forces would be able to assert superiority at sea over any combination of foreign

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navies which might be brought against us, and consequently that any movement of hostile fleets on a large scale would be dealt with by our navy within a short time of its commencement. In home waters this period was estimated to be not more than 48 hours. In foreign waters, however, it was clear that no estimate could be made, in view of the scattered nature of our over-sea possessions.

From this followed three main conclusions :—

(a) That an invasion of Great Britain by a large army with all its necessary impedimenta would certainly be impeded, if not actually prevented, by our navy, and that consequently a continuous line of defences round our coasts was not required.

(b) That it was possible, however, that individual ships or squadrons, detached from the enemy's main fleet, might be able to carry out attacks of the "tip and run" nature upon our ports, and that small raiding forces might be landed in undefended localities, and thence attack our fortresses from the land side.

(c) That immunity from attack upon our oversea ports could not be absolutely guaranteed by the Navy.

It is obvious that to make our ports, home and foreign, entirely secure against attack, would have entailed the provision of local defences at each of them, and it is equally obvious that, since our resources, even in pre-war days, were not unlimited, such a course of action could not be adopted. The accepted policy, therefore, was to provide local defence for certain areas which contained important and vulnerable objectives, and to accept the dangers incurred by leaving the less important places undefended. In order to determine the form which such defence should take, it was obviously necessary to consider the nature of attack which might be expected. In view of the probability that hostile forces attacking a defended port would almost certainly be themselves attacked by our naval forces within a few hours, it was decided that, except in a few special cases, it was unnecessary to provide for complete protection against prolonged operations. The important requirement was that the defences should be of such a nature as to act as a powerful deterrent to attack by hostile ships. At certain ports, especially many of those abroad, the minor importance of the port or the improbability of attack by heavy ships made the provision of the full scale of defence required for large fortresses unnecessary, and in other places the special probability of one or other form of attack called for modification in the means of defence. In fact, the defence of every locality had to be considered on its own merits, with due regard to the importance of the place, its distance from enemy bases, coastal and hydrographical features, etc.

Briefly, the principles on which our schemes of defence were compiled were :—

(a) To keep bombarding ships at such a distance from the

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fortress, as to prevent serious damage to important targets lying within it.

(b) In the case of home ports, to hold off an attacking enemy until our naval forces should have time to arrive and deal with him by fleet action.

(c) To prevent the entry of torpedo craft into harbours and roadsteads.

(d) To repel attempts at mine-sweeping or the removal of booms or other obstructions, and to prevent the blocking of narrow channels by enemy mine-layers or blockships.

(e) To resist attack from the land-side for a sufficient time to allow of the arrival of our own land forces.

CHAPTER III.

EXAMPLES OF ATTACK AND DEFENCE OF COAST FORTRESSES DURING THE GREAT WAR, AND LESSONS TO BE LEARNT THEREFROM AS TO THE PRINCIPLES OF DEFENCE.

Perhaps one of the most noticeable features of the war, in which sea-power played so great a part, and in which the navies of every one of the great naval powers took part, was the paucity of instances of attack on land defences or defended areas by warships. A few of the more noticeable are as follows :—

(i). *The naval bombardment of the Dardanelles.*

This consisted of a deliberate attack by battleships on permanent shore defences, with a view to destroying them so completely as to allow of the entry into the defended waters of craft charged with the duty of removing minefields and other obstacles, and thus to clear a passage into the Sea of Marmora for our fleet, military transports, and various auxiliary craft. The chief lesson to be learnt from this example is that, in a direct duel between ships and forts, the odds are distinctly in favour of the forts. One lucky shot from a ship can, at best, demolish one gun of a fort. On the other hand, one lucky shot from a fort may quite easily neutralise at least half of the guns of a ship. And moreover, owing to the difference in size of the target, and the advantage accruing from the possession of a fixed and stationary platform, the prospects of accuracy of the land gun are enormously greater than those of the ship's gun. Further, the ship's gun, being designed primarily to engage other ships, and being required to pierce a considerable thickness of armour, is necessarily of very high velocity and therefore of flat trajectory, and employs a very different type of projectile from that which is the most suitable for the attack of land defences. The flat trajectory renders it ill-suited for engaging any but direct-fire targets, and considerations of space prevent the carrying of two classes of projectile.

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(ii). *The bombardment of Madras, Whitby, Scarborough, and other open or lightly-defended coast Towns.*

These bombardments, which were all of the "tip and run" nature, only serve to teach us the impossibility of rendering our coasts completely immune from attack. In neither case was there any great military advantage to be secured by the enemy, and in neither case did he inflict on us any damage which could have a real effect on the war as a whole. And, in one or two cases at least, the incidents went to prove the wholesome dread felt by a surface ship of coming within range of even the smallest guns of a coast battery.

(iii). *The German torpedo-boat attack on Dover.*

This attack was entirely half-hearted, and was not pressed home. This was perhaps chiefly because it was made without any very definite object, but was also, no doubt, partly on account of the readiness of the defences.

(iv). *The blocking of Zeebrugge.*

This operation was in every way a model. Its success practically crippled the German submarine campaign, not merely by the loss of the use of the vessels which were shut in, but by the denying to the enemy of his advanced submarine base. It was a triumph of organization and foresight. Every possibility had been considered, every development forecasted, every element of risk eliminated as far as possible. For these reasons it succeeded completely, where every similar attempt in previous history had been either a complete or partial failure.

The operation consisted of several features.—Long-range bombardment of the heavy guns of the defence, short-range bombardment of the light guns, a raid on the land defences by landing-parties, attack on the boom and net defences by small craft, and finally the sinking of three large vessels in the narrow entrance of the canal, inside which was the submarine anchorage.

The chief lesson to be learnt by the defence from this attack, is, we think, the necessity for a high standard of training in the personnel. Two points seem to emerge from the reports of the action above all others, namely :—

(a) The diversion created by the appearance of the "Vindictive" alongside the mole was indeed a diversion. It apparently caused every man of the defence to look westwards, with the result that the blockships coming from the north-east were not engaged until too late.

(b) When the "Vindictive" emerged from the smoke-screen within 100 yards of the mole battery, excitement caused the gunners to fire point-blank at her sides, instead of at her water-line. Consequently no vital damage was done. Had she been riddled on the water-line, she would possibly have been unable to close on the mole, and in any case she (and therefore her landing parties) would never have been able to get away again.

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(v). *Attack on shipping at Constantinople by our submarines.*

This operation, although its success had, perhaps, but a small effect on the war, teaches to the defence the useful lesson that, however thick be the mine-fields, and however many the booms or net defences, a determined submarine commander, provided he has sufficient depth of water in which to manœuvre, may at any time penetrate them, and hence that no material obstacle can be a substitute for vigilance in look-out duties and instant readiness for action on the part of all defence personnel. Here again we see the need for a high standard of training.

CHAPTER IV.

DEVELOPMENTS DURING AND SINCE THE WAR.

The changes in methods and material during the recent war have, indeed, been immense. Perhaps the greatest development, and that which will exercise the largest influence on our future methods, has been the introduction and perfection of a new arm, i.e., the aerial fighting machine. Before we study this new arm, however, it seems advisable to consider what changes have taken place in those we knew formerly. Let us therefore look at the development of the power of attack, i.e., of naval power.

Developments in the attack.

The most striking innovations are :—

(i) *The increased range of guns.* Where, formerly, it was considered that a fortress would be comparatively immune from damage if hostile vessels could be prevented from closing within 15,000 yards, it is now possible for accurate bombardment to be carried out (provided that means of observation exist) at ranges up to 40,000 yards or even more.

(ii) *The increased speed of ships.* This factor increases the probability of attack, by reason of the added facility afforded to the attacker for rapid concentration for a raid.

(iii) *The development of small craft.* The coastal motor boat, with its small size, high speed, and wonderful steering qualities, has introduced a new power to the close attack by torpedo of vessels lying in roadsteads or harbours. Owing to its small size, it will be exceedingly difficult to detect during the hours of darkness, and its high speed and quick steering will render it a peculiarly difficult target to engage with gun-fire. It is, however, very vulnerable, and a single hit from even the lightest gun will probably be sufficient to cripple it.

(iv) *The light-draught heavy gun carrier.* This type of vessel, known as a "Monitor", was primarily designed for operating in the shallow waters off the Belgian Coast. It is practically unarmoured and carries one gun (or two) of the

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largest size. Its rôle is bombardment of land targets where the small depth of water will not allow of the operations of larger craft. For this reason it is particularly invulnerable to submarines. It is not designed to fight against other warships, and consequently it can only operate during the absence of hostile vessels or when protected by units of its own fleet, but, for the same reason, it can use a type of projectile more suitable for engaging land targets than can the capital ship.

(v) *Artificial fog.* This development, given the required atmospheric conditions, is a very powerful adjunct to certain forms of attack, such as blocking, boom-smashing, or attack by light craft. It can also be employed where long-range bombardment is being carried out by indirect fire. It is, however, a weapon which may recoil on the head of its user, should a change of wind occur unexpectedly, and it also suffers from the disadvantage that it can only be used under suitable atmospheric conditions, so that it may not be available at the very time when it is most desired.

Developments in the Defence.

As regards the defence, developments have been few, owing to the rarity of attacks. They have been chiefly in the direction of improvements to existing means and methods, rather than in the introduction of innovations, and have mainly affected the ancillaries of coast defence, such as means of observation, range-finding, etc.

Developments of the air arm.

It is unnecessary to labour the point of the vast changes introduced, both for the attack and the defence, by the development of air-craft.

Where, formerly, we had to consider operations by sea and land only, we now have to make preparations for warfare in a third element. Our ideas, therefore, both of attack and defence must necessarily be largely revolutionised, and our methods will require adjustment, in order to meet the new conditions.

Air-machines, whether in attack or defence, have three main functions to perform, viz :—offensive action, reconnaissance, and observation of fire.

Let us examine these activities from the points of view of the attack and the defence separately.

(a) *Air-craft of the attack.* The first, and perhaps the most important, point to notice, is that one of the chief factors in successful attack is enormously strengthened by the advent of air-craft, i.e., the factor of *surprise*. Not only does the immense speed of aerial machines very greatly reduce the time occupied between the inception and delivery of an attack, but their small size and consequent ease of concealment renders the preparation of, and concentration for, attack

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immeasurably less easy of discovery by the scouts of the defence than in the case of assemblies of naval or military forces. Where, in the old days, we might expect some *days* notice of an impending attack, we shall now probably have only as many *hours*. This consideration, therefore, shows that one of the first requirements of the defence is—Instant readiness for action.

The objectives of an aerial offensive action will be, so far as coast fortresses are concerned, the same as those hitherto accepted as the objectives of naval attack, i.e., firstly, important works, buildings, docks, etc., lying within the defended perimeter, secondly, warships lying in harbours or roadsteads, and thirdly, the actual works of defence themselves. An aerial attack will be made both by bomb-dropping and fire from machine-guns. Owing to the speed at which it will be carried out, there can be no question for the defence of "holding off" the attacker pending the arrival of our aerial fleets, as in the case of bombardment by sea. If our fighting air squadrons are not actually on the spot, the attack will necessarily be finished before they can arrive.

The second function of the attackers aircraft will be reconnaissance, for the purpose of discovering the dispositions and activities of the defence. This function may be combined with offensive action as described above.

The third function, observation of fire, will necessarily be an adjunct of a naval bombardment, and, by its means, such bombardment will be possible at the most extreme ranges.

It must be observed that both these two last functions will necessitate the presence of the attackers machines over, or in the close vicinity of, the fortress for some considerable time, during which they will be liable to be themselves attacked by gun-fire and by the defender's air-craft. They will therefore certainly be accompanied by fighting machines, for their protection while carrying out their duties.

(b) *Air-craft of the Defence.* The main functions of the defender's machines may be stated in order of importance as follows :—

Reconnaissance—in order to give timely warning to the garrison of an impending attack by air, sea, or land.

Fighting—to destroy or drive off the attackers machines when approaching the fortress for either of the purposes mentioned above, and also for the protection of the machines engaged in—

Observation of Fire—to assist the artillery of the defence in dealing with an attack by naval forces.

Offensive action—the direct attack, by bombing, of hostile vessels.

CHAPTER V.

ATTACK AND DEFENCE.

As we have seen above, we must be prepared to deal with land attack, naval attack, and aerial attack, therefore our defences must consist of land defence, seaward defence, and aerial defence.

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Land Defence.

It has always been accepted as an axiom that, as a general rule, the land defence of a coast fortress is the business of field forces whether located within the perimeter or operating against the attacker from without. In certain localities, however, no such protection may be available, and, in any case, it will be necessary to provide some means of defence from within, to guard against capture by a coup-de-main, before the field army can arrive on the scene. For this purpose every coast fortress must include in its garrison mobile troops of some description. The duties of this mobile force may be stated as :—

(a) The close defence of vulnerable points.
(b) To hinder a landing by the enemy, within, or near to, the fortress.
(c) To attack the enemy when disembarked.
(d) To hold the landward front in the case of isolated fortresses, or in the absence of a field army.
(e) To maintain order among the population within the fortress.

The main object of the land defences is to keep the enemy as far away as possible from the fortress. For this purpose, therefore, risks will have to be accepted, and great mobility and a high standard of training will be necessary. In certain isolated places, the guns of the seaward defences are so sited as to be able to engage an enemy attacking from the land, but this is a subsidiary, and not their primary, rôle.

Seaward defence.

The defence of a fortress against attack from the sea has, in the past, consisted of—

(a) Extended defence, provided by the navy, and consisting of cruisers, destroyers, submarines, etc., whose object is to seek out and attack hostile vessels before their arrival within range of the guns of the fortress, and
(b) Local defence, consisting of guns and searchlights provided by the army, and booms, nets, and minefields provided by the navy.

It is important to notice that the Admiralty, though approving the principle of extended defence, and though willing to supply the means whenever possible, has always declined to allot mobile forces permanently for the defence of particular localities. This attitude is undoubtedly reasonable, since the main object of our navy is to clear the sea of the enemy's fleets, and not merely to stave off his attacks whenever and wherever made.

As regards local defence, the chief point to consider is the coast defence gun. We have seen that the increased power of naval guns, combined with the development of the air arm, has made it possible for bombardment to be carried out at ranges hitherto undreamed of. At the same time we know that the chief deterrent to bombardment by capital ships is the fear that they, the important units of the enemy's

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main fleet, may be destroyed in carrying out what is only a subsidiary operation. And therefore we might assume that long-range bombardment on a large scale need not be anticipated. But here we must remember that the capital ship of to-day is the obsolete ship of to-morrow, though armed with the same gun and protected by the same armour. Hence we must be prepared for bombardment in the future from ships which have all the power of the present-day capital ship, but which, being then obsolescent, the enemy will be prepared to sacrifice. It will therefore, perhaps, be not unfair to lay down certain assumptions, e.g.

(i) That the enemy will not risk his (then) capital ships, if possible.

(ii) That he *will* risk his obsolescent ships and monitors, in direct proportion to the importance of the place he is attacking.

(iii) That 40,000 yards is a reasonable range at which we must be prepared to engage him.

(iv) That the guns which we employ must be capable of penetrating present-day deck armour at that range.

For these two latter purposes it is evident that our present heaviest coast defence gun is unsuitable. It must therefore be replaced by a more powerful gun, and it would appear that nothing less than the 12″ would answer the purpose, if, indeed, it is sufficient. Probably a 15″ gun will be required.

Similarly, since attack by cruisers or block-ships will be carried out by vessels of present-day protection, our medium armament will require to be strengthened, and for this we suggest the 9·2″ or 7·5″ gun, according to the importance of the port.

Our light gun, for defence against torpedo craft, is an important consideration. It will not be sufficient to *damage* a hostile vessel,—it is essential to *stop* her before she arrives at a position where she can do damage. For this purpose, our light armament should consist of 4·7″ to 6″ guns, with perhaps a light automatic gun, or heavy pom-pom, for dealing with craft such as coastal motor-boats.

This re-armament appears, at first sight, to be a formidable matter—but it is not, probably, so large as it seems. We are not proposing to provide against operations by large numbers of vessels, but against individual ships or small groups. Consequently, though we suggest increasing the *power* of our guns, we could probably reduce their *numbers*. Due consideration of the probability of attack at each port, followed by careful siting of the allotted armament, would probably enable us to provide the necessary deterrent against bombardment, and the necessary obstacle to success of other forms of attack.

Guns on railway mountings.

Many suggestions have been made, from time to time, that the most economical method of defending our coast would be the installation of heavy guns on railway mountings, running on railways which

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should be laid along the coast line. The argument in favour of this is that it would deny to the enemy many sea areas from which, at present, he can carry out long range bombardment unmolested by gun fire. There are, however, several arguments which can be advanced against this proposal, among the foremost of which is the loss of accuracy in gun fire which it would entail. We do not want only to frighten the enemy, but to damage him. And financial considerations demand that we should do this damage with the smallest possible amount of ammunition. In other words, every round should be a hit. Provided that we have a gun, powerful enough to reach an enemy vessel at any range within which it must approach in order to bombard, and sited in such a way that, with aeroplane observation, it can engage a target in any direction within that range, it appears that it would be unwise to sacrifice the advantages conferred on the gun by the possession of a fixed and stable mounting. It would seem that the protagonists of railway guns overlook the fact that coast fortresses are not designed to protect the whole of our sea-shore, but are intended merely to protect important objectives lying within their perimeter.

Aerial Defence.

As on the sea, so in the air, will it be necessary to provide for extended, as well as local, defence. The former will, of course, be solely the function of the R.A.F. The latter will be the combined duty of the army, with guns and searchlights, and of the R.A.F., with fighting aeroplanes. And here we arrive at a most important consideration. In local defence seaward, the part of the navy is restricted to what may be termed the passive defensive, i.e., defence by means of mines, booms, nets, and other obstructions to navigation. In local defence air-ward, however, it must be accepted that no such passive defence can be completely efficacious, and hence the part of the R.A.F., must be an active defensive. All recent developments seem to show that the R.A.F., is becoming more and more truly independent, and there may well be reason to fear that the Air Ministry may adopt as regards both extended and local defence, an attitude similar to that of the navy in regard to extended seaward defence. Such an attitude would, of course, be deplorable. For local defence against aerial attack, the defence commander must have, as the chief of his weapons, a definitely fixed number of aeroplanes, and these machines must not be susceptible to removal without his consent. They must be looked upon as a permanent portion of the armament of the fortress, of equal importance with the anti-aircraft gun, since it must be admitted that guns alone cannot at present compete completely with aircraft.

The main objects of the air defences will be to guard against :—

(a) Bombing attacks on ships or other important objectives within the fortress.
(b) Bombing attacks on the works of defence.
(c) Reconnoitring or observing aircraft.
(d) Torpedo dropping aircraft.

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In order to carry out these attacks with accuracy the enemy aircraft will have to fly at a low altitude. It will be the object of the aircraft of the defence to endeavour to prevent this low flying, by attacking the enemy during his approach to the fortress, but, should he evade the defenders, it will be for the guns of the defence to deter him from close approach or destroy him when carrying it out. An efficient organisation of anti-aircraft guns will therefore be required. These guns should be of the nature of 4″ calibre, and should have an effective height of at least 20,000 feet.

There is very little doubt that many of the attacks will be made at night and consequently provision must be made for anti-aircraft searchlights, both of the "sentry beam" nature and fighting lights. These searchlights must be entirely distinct from those of the seaward defence, though of course each will assist the other if not required for its own purpose during an attack.

CHAPTER VI.

CONCLUSION.

We have seen that the Coast Fortress of the future will be liable to attack by land, sea, and air, and that to meet these attacks we shall require military, naval, and aerial, defences. In the case of each form of attack, a combination of at least two of the means of defence will be required. Thus our first and greatest lesson is the need for the closest possible co-operation between the three fighting services.

We have seen that developments of the past few years have greatly enlarged the scale of attack which may be expected. Hence we see that the scale of defence must similarly be greatly extended.

In the remarks above, for reasons of space, little has been said about the progress of what may be termed the ancillaries of attack and defence, such as the various methods of detection and ranging, surface, sound, and sub-aqueous, the development of lethal and non-lethal gas, the methods of producing artificial fog, the use of anti-bomb nets, bomb-proof protection, camouflage, etc. These matters are all more or less in their infancy, but they are advancing with rapid strides, and we must not allow ourselves to fall behind other nations in these respects. Thus our third lesson is the need for continuous and pains-taking experiment and research.

Having learnt these lessons, we must then apply them. It has been pointed out that all coast fortresses cannot be treated, for purposes of defence, on the same lines. The first thing to do is to determine the probable scale of attack. This, as we have seen, will depend upon the desirability of the objectives, the distance from enemy bases, and political and natural considerations. Having decided on the probable scale of attack, we can then calculate the necessary scale of defence. And when this has been done, the final step is, obviously, to carry it out. This is the ideal. Is it, however, practical? We think not. We have seen that to provide a full scale of defence under modern conditions will, in most cases, entail a considerable rearmament of exist-

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ing fortresses, and we have to bear in mind that the present financial stringency precludes any expenditure which is not absolutely vital to our safely. Also we must recollect the two 10 year factors mentioned in chapter I, and their bearing on our problems. When looked upon from this aspect, it appears that it would be folly to expend a large amount of money at this juncture, on heavy rearmament of, or on full complements of personnel for, our coast fortresses. There are, however, certain fields of activity which must on no account be starved. We refer to experiment, research, training, and practice. The development of methods of attack and means of attack, though perhaps retarded, will not stand still, and it is incumbent on us to ensure that means and methods of defence are developed in at least an equal degree.

From war experience we arrive at certain deductions, which, however, require modification in accordance with post-war conditions. What, then, may we anticipate as being the condition of our coast fortresses during the next ten years? Guns in a state of "care and maintenance", P.Fs. and other instruments dismantled or covered up, mine-fields un-laid, anti-aircraft defences non-existent, and, last but by no means least, personnel cut down to the minimum required as caretakers. This will certainly be the case during the next year or two, while financial conditions are so stringent. But it must not be allowed to continue indefinitely. So long as human nature remains what it is, so long will fighting be the ultimate method of settling differences. Peace Conferences may assemble, Leagues of Nations may record resolutions, and the international policeman may intervene between disputants, but, though these bodies may *dissuade* from or *forbid*, they cannot *prevent*, war.

The statement which forms the motto for this paper was never more true than it is to-day, although war-weariness has, perhaps, blinded us to the fact. We have, no doubt, to face a period of stagnation as regards our coast defences, until more money is available for their development. But we must, as soon as our finances allow, begin a progressive and comprehensive re-armament and re-organization on the lines described in these pages. And, during both the period of stagnation and the subsequent period of development, we must do our utmost, by experiment and research, to keep abreast of every scientific and mechanical advance, and we must establish that close co-operation between the Army, the Royal Navy, and the Royal Air Force, which alone can ensure the proper fulfilment of the rôle for which our coast fortresses are designed.

Training, owing to shortage of personnel, is almost impossible of achievement for the time being. We can at least, however, train as *instructors* the scanty personnel we possess, so that in the brighter days to come they may be able to teach the "new entry". And it seems desirable here to emphasize that it will not be sufficient to rely entirely on the Territorial Army for the artillery portion of our coast fortresses. Not only does the R.G.A., form an important reserve of very highly

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trained men for the field army, but, in the critical early days of a war, it will be essential to have our defences manned by personnel who will not require any "shaking-down" process as a prelude to efficiency.

Thus, then, the future which we deduce for our coast defences during the next ten years is :—

(a) A period of perhaps two or three years during which the whole of the money available for the fighting services will be devoted, and rightly so, to the organization and perfection of our means of offence, and the passive defence, as represented by coast fortresses, will remain "in statu quo". During this time no re-armament or other material development will be possible, and training will be practically nil.

(b) The period subsequent to (a), when the return of financial prosperity may enable us, not only to complete our preparations for the offensive, but also to devote funds to the development of the defensive. During this period, our defensive energies will be turned, in increasing intensity, to the development of our material and the training of our personnel, up to the standard which our war and post-war experience shows to be necessary.

(c) And, throughout the whole of both these periods, we shall be carrying on systematic and painstaking experiment and research, so that we may ensure for ourselves a position at least abreast of our possible rivals, should the peace of the world again be disturbed.

There is no doubt that the mere existence of the first, i.e., the stagnant, period will exercise a damping effect on the ardour of many an otherwise enthusiastic garrison gunner. But let us remember that, the lower we fall, the greater will be the honour when we have again raised coast defence to the eminence attained by it in the past. And the rapidity with which we can do this will depend on the extent to which we fit ourselves, during the stagnant period, to instruct those who follow us.

Experiment, research, co-operation, training. Let these be the watchwords of our coast defence organization, and we may then look forward with confidence to a time when, with our defences re-armed in accordance with the demands of the two former, and our personnel prepared by the two latter, we may face any or all of our potential enemies, saying, in the words of the song—"We don't *want* to fight, but, by Jingo, if we do—".

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SURPRISE, RAPIDITY, CONCENTRATION.

Warsaw, 20 February, 1922.

Captain Gen. Staff of the
Polish Army
Eugene HINTERHOFF.

To the Editor of "The Journal of the Royal Artillery."

While looking through the small military library of an English officer, a friend of mine, it gave me much pleasure to become acquainted with the Journal edited by you and which, owing to the small number of the population acquainted with the English language, is, alas, so little known in Poland.

Of all the articles published one especially attracted my attention and created a series of reflections in the sphere of the experience given by the Great War—namely the article by Colonel Rowan-Robinson entitled "Surprise, Rapidity, Concentration" and published in January 1921.

The Polish-Bolshevist war in which I took part and the civil war in Russia crowned with the suppression of all anti-Bolshevist military movements, the course of which I had an opportunity of studying thoroughly while acting as an official of the II. Department of General Headquarters, both so different from the Great War and so little described in the literature of Western Europe, give a series of very characteristic examples of surprise, rapidity and concentration. With the aid of this still raw historical material and the newest after-war literature (Foch and Clausewitz though old still hold good).

I have taken upon myself the liberty of expressing Col. Rowan-Robinson's ideas in a different form and with somewhat more extended scope, and I send my article to you, requesting you to publish it, if possible, in your esteemed Journal.

I am yours very sincerely,

Hinterhoff, Capt.

"Les moyens de la guerre evoluent, les principes directeurs subsistent"—Foch.

In the instructions of the German Headquarters, issued in 1918, before the great spring offensive and based on the previous four years experience of the Great War and a deep analysis of the same, the chief stress was laid on three factors which when applied in combat give security for the gaining of victory.

These factors which had already played a part in the wars of bygone days, often applied unconsciously by commanders, Ludendorff,

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one of the most talented pupils of Schieffen the originator of the German military doctrine formulated as : surprise, a speedy concentration of means of fighting, rapidity and energy in execution.

These principles well known also to Napoleon the genius of the Latin race, who expressed them epigrammatically, as "*surprise, masse, vitesse*" and developed by the professor of l'Ecole de Guerre, the late colonel and the present marshal Foch in his standard work "Principes de la guerre" into the theorem : "*Briser la volonté de l'ennemie tel est donc le premier principe, que nous indique l'etude ; la briser par un coup innatendeur d'une vigeur supreme, telle est la première consequence de ce principe*"—were duly appreciated by the French military staffs and applied successfully in the Great War.

In a little skirmish fought by volunteers' detachments badly armed and trained, as well as on large fronts, hundreds of kilometers long, where powerful armies equipped with the last achievements of technique are led according to the newest military doctrine—these principles, often unconsciously applied, run like a purple thread through all victorious decisions of the commanders. For they belong to the c ass of those, rare, old and yet always new truths—axioms of the art of war which will last until the question of general disarmament, still more or less successfully discussed by candidates for Noble's prize, even by eminent statesmen at different conferences—becomes realised.

Independently of the strength of the troops, armament and training they play an important rôle in all forms and phases of war, beginning with the period of peace, when troops ought to be distributed in a way which will enable in case of new mobilisation a speedy concentration of the armies on the frontier facing the enemy, as well as in the moment of a great decisive battle, depriving the enemy of his arms and bewildering him by a bold pursuit.

A small war, as well as the great moving battles of the XXth and the past centuries and the trench warfare reached on the Western front during the Great War—all give a number of characteristic episodes a deep analysis of which will enable us to find out how these three principles together co-operating harmoniously, or each of them separately, affect the course and issues of military operations.

A full application of these principles while preparing an operation, their harmonious co-operation in action and in the exploitation of victory—that is the ideal solution of this problem and as such it was well understood by all military geniuses of the different periods of history.

Surprise.

Studying the harmonious co-operation of these 3 principles and their relation to each other we must give the first place to surprise because of the moral effect produced by it, when successfully applied, as well as on account of the fact, that a moral effect unsupported by rapidity and concentration will be fruitless. "*Die überraschung liegt*

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ohne Ausnahme allen Unternehmungen zugrunde, nur in sehr verschiedenen Graden nach der Natur der Unternehmung und der übrigen Umstände"—Clausewitz.

Surprise which deprives the enemy of his presence of mind and consequently of his reasoning powers is a means of breaking his spirit, a guarantee for decisive victory.

"*Should it be something pleasant, or awful, the less it is expected the more it creates joy or fear. This truth may be particularly observed in a war, when every surprise frightens even the most courageous men"—Xenophon.*

This moral effect may be reached, for example, by a sudden unexpected appearance of a great number of hostile troops—hence in all ages is to be observed a tendency to surprise the enemy, to catch him in a trap and especially by employing cavalry to outflank him, to appear at his back creating panic, by a night-attack which exhausts a soldier's soul the most, or by applying a new technical invention unknown to the enemy and against which in the first moment he cannot secure himself—hence this constant and secret development of military technique which began with Greek fire and Archimedes's lenses and ended with gas, tanks and ultra—violet rays.

However the mere moral is fruitless; it must be at once utilised by a speedy throwing of the massed force in a previously determined direction.

The starting point of the striking forces must however be close to the enemy with a view of using them speedily against the surprised and bewildered opponent.

If this principle is not fully applied the attacking part, despite its predominance given by the moral state of its troops and their concentration on the given sector, will lose all the benefits of its moral preponderance gained by surprise, for the enemy will have plenty of time to recover consciousness.

Thus a surprise in order to reach this end, the victory over the enemy, requires three conditions: a sufficient concentration of troops, time and space.

We find the efforts to apply these principles throughout history, in the art of war of Alexander, Cæsar, Hannibal, the Polish hetmans of the 17th century, Gustavus Adolphus, Frederic II, Napoleon, Blücher, Moltke, Lords Roberts and Kitchener—finally in the doctrines of the XXth century and in the last after-war achievements.

All the different methods of tactics always had the chief aim in view: by the sudden appearance of great forces, unexpected and boldly used, to break the spirit of the enemy and while he is still deprived of his strength to carry out the decisive attack.

This bold unexpected attack of concentrated troops should not be carried out on the whole front; for an army is a delicate organism sensitive to the feelings of its particular organs, hence Napoleon's maxim: "*L'art de la guerre consiste a avoir toujours plus de force que*

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l'adversaire, avec une armée plus faible que la sienne, sur le point où l'on attaque, ou sur celui, où il vous attaque.''

Napoleon's campaigns, above all the battle at Wagram is one of the most classic examples of surprise created by the sudden throwing into action of massed forces: Macdonald's corps composed of 50 battalions, 22,500 men, and 40 squadrons (which in those days was a considerable force) supported by 102 cannons was suddenly thrown into action and therefore it turned the scale in favour of Napoleon and a difficult tactical situation was changed into a brilliant victory.

In the history of Poland we find many examples of battles won owing to sudden use of reserves, only to mention the attack of the heavy cavalry before Kluszyn, or that of the hussars at Vienna.

Generally speaking, it is easier to apply a surprise in tactics than in strategy on account of the lesser swing of the operation, the shorter time required for the execution and the preparations and the fewer forces. Not to speak of Napoleon's wars and those of 1870, the wars of the XXth century, beginning with Transvaal war, furnish many characteristic moments of surprise not only in particular tactical manœuvres, but also in strategical operations performed on an extensive scale.

The Japanese in the Russo-Japanese war tried to apply it constantly. The Russo-Japanese war began with a night attack on a Russian naval squadron lying in the harbour of Port-Arthur. *''La strategie japonaise par cela même qu'elle avait conscience de son inferiorité numerique, elle n'a pas manqué d'exploiter le moyen par excellence des faibles; la surprise.''—Gen. Mordacq.*

Particularly, however, the Great War and our war with the Bolsheviks abound in examples of strategical surprises e.g.: the German offensives in 1914 and 1918, Caporetto, Gorlice, Riga, the operations in Rumania, Brusilow's offensive, the Austrian offensive on the Stochod, Cambrai, Krewo, and finally the French counter-offensive. From the Polish-Bolshevist war we may quote, among others, Vilno, Mozyrz, Kalenkowicze, the counter-offensive before Warsaw, on the part of the Poles, and the first and second offensive on the Northern front, the forcing of the Dnieper—on the part of the Bolsheviks; from the war between Wrangel and the Soviet, so little studied as yet and abounding too in interesting examples: the forcing of the Crimean isthmuses and Wrangel's decisive defeat.

Concentration.

Mere surprise, as it was said above, producing only a moral effect on the enemy is fruitless; it must be utilised by a rapid and decided attack of the previously concentrated forces. Here the idea of concentration comes into play. *''Das Gesetz, welches wir zu entwickein versuchen, ist also: Alle Kräfte welche für einen strategischen Zweck bestimmt und vorhanden sind, sollen gleichzeitig auf denselben verwendet und diese Verwendung wird um so vollkommener sein, je mehr alles in einem und in einen Moment zusammengehängt wird.''—Clausewitz.*

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A concentration begins already in the first moments of given alarm, when cover-troops are speedily transferred to the frontier with a view to shield one's own regions of concentrations.

All efforts of the staffs organising the army during a period of peace have one aim in view, namely by hurrying one's own mobilisation, and consequently by beginning operations earlier to forestall the opponent's concentration on the frontier.

To complicate the enemy's concentration, and to prevent the execution of his strategical plans, worked out in times of peace—provides, at the start, a great success for it robs him of initiative and compels the adoption of a defensive position.

Especially in this first stage of war, during the strategical movement of troops, full stress is laid on secrecy with a view to surprising the enemy.

A striking example of a concentration executed in this way was the German army's concentration on the Belgian frontier in 1914; only two weeks after the outbreak of war the French General Staff, which had concentrated the bulk of its forces on the Alsace—Lorraine frontier, realised that was the planned direction of the German attack and while fighting battles on its retreating left flank carried out a great movement of troops by rail.

In the later stages of war this concentration idea becomes the integral part of all intended operations.

While comparing the Great War, especially its phases of trench warfare, with the wars of past centuries we may observe an evolution of the idea of concentration. In the wars of past centuries a surprise executed by smaller forces and with a speedy exploiting of the moral effect thus obtained by a decided attack—was sufficient to gain a crushing victory.

The history of Polish cavalry in the 17th century furnishes examples of that kind, when many a brilliant victory was gained over an enemy who had a preponderance both in numbers and material. Thus Charles IX's Swedish army was beaten at Kircholm in 1605 by Chodkiewicz, who had only 3,700 soldiers; thus Zókiewski before Kluszyn in 1610 commanding 4,000 soldiers conquered 48,000 Russians. "*This rapid, unexpected method of attack of our cavalry, its chief characteristic, continued as long as the old-Polish army, i.e. to the end of Jan Sobieski's reign.*"—*Kukiel.*

The idea of concentration thus formulated appears somewhat modified in Napoleon's conceptions, expressed in his maxim: "*masse, vitesse, impulsion*" as well as in the German maxim: "*getrennt marschierenzusammen schlagen.*"—*Moltke.*

If in the wars of past centuries a series of victories were won by means of manœuvre, often by considerably smaller forces (e.g. the outflanking manœuvre of the Japanese at Laojan)—yet the importance of concentration gradually came to be realised and in the Great War the idea of concentration reached its highest point of development.

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A front hundreds of kilometers long, possessing well fortified flanks rendered any manœuvres, conformably to pre-war doctrines, difficult, if not impossible, thus giving the first place to the idea of brutal frontal attack for breaking the enemy's front-line.

The increasing development of military technique, supporting effectively the opponent's defensive force creates the necessity of a concentration both of men and material on the given sector in order to break the enemy's resistance.

Taking into consideration that modern European armies, based on the principles of general military service and trained armed and equipped with almost the same military materials—are equal, as regards their fighting power, it may seem that in trench warfare on a continuous front only one strategical conception is possible, namely one great, frontal attack composed of a series of separate frontal attacks.

Having such a conception of war which is a "mechanical conception", not to speak of the use of local reserves, new movements of troops with a view to carry out strategical manœuvres seemed to be impossible and the rôle of the commander would have been reduced to a mechanical supply of men, military materials and food.

However, if we study the Russo-Japanese war, still quoted as an example by adherents of the "mechanical conception" of war as well as the great operations of the Great War, we shall find in their execution not only the forcible breaking of the middle front but also "*l'idee du manœuvre*" consisting either in a combination of frontal attacks with operations on the flank, or an attack executed on the point of contact of two armies and extended by an action on the flank.

In all these cases the execution of the manœuvre depends on the employment of one's own massed force on a given sector, meanwhile holding the enemy in check on the rest of the front. An appropriate concentration both with regard to tactics and numbers, is the first condition of victory. This fact particularly raises the importance of concentration.

The Great War displayed its importance, when a whole series of operations, despite a considerable tactical success at the beginning, did not end in victory—a classic example of which is the battle at Cambrai.

It is especially of great importance to maintain a sufficient concentration throughout while executing a manœuvre; for example in the German offensive in 1914, Brusilow's offensive in 1916, before Caporetto, and finally the Bolshevist offensive against Warsaw, despite considerable success at the beginning, the troops going victoriously forward but unsupported by reserves (on the contrary—e.g. 11 divisions of infantry and a corps of cavalry was taken from the the army of General von Kluck and of Bulow and transferred to the Russian frontier)—broke under the counter-attack of the reinforced opponent, who had time to collect his reserves.

The mere knowledge of the enemy's concentration creates at once a series of corresponding decisions.

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The overwhelming concentration of forces on the French side in 1918 and the impossibility of reaching an equal number was a fact realised by the Germans and which induced them to capitulate.

Rapidity as well as concentration plays a part in all stages of war. Already in the period of peace the rebuilding of railways with strategical aims in view, all technical improvements and the elaborated transport—plans which should increase the efficiency of railways—all this proves that the High Command aims at obtaining speedy movement of troops in given regions of concentration according to its plans of operations. All theoretical debates as well as the corresponding orders concerning the speeding up mobilisation, and the training of troops in the regions of concentration have also this aim in view, namely of putting the army, as soon as possible, on a war-footing and its most appropriate grouping for the execution of the intended operations. The Germans rebuilding their railway system on the Belgian frontier and the Russians doing it in Congress-Poland and in Ukraine give us examples of those tendencies of rapid strategical movements.

The results of such speedy groupings of troops were displayed distinctly in the first weeks of the Great War, when the German avalanche moved rapidly onward and was held up with great difficulty before Paris, and when the Russians gained many victories over the Austrian army.

The false estimation of the Austrian General Staff as regards the Russian rapidity and energy in the execution of their mobilisation and the concentration of their armies was one of the causes of Austrian defeats at the beginning.

A hasty beginning of the operations, especially the throwing of a considerable force of cavalry into action prevents the enemy's concentration and moreover it enables the one side to invade a great stretch of the hostile country, therewith raising the moral state of its troops.

Doubtlessly the throwing of a considerable number of the Russian cavalry into East Prussia, which was expected with fear by the Germans, as we may judge by their after-war literature, would have considerably affected the later course of military operations. At all events, the German army during its march on Paris was weakened by the sending away of many divisions of infantry and one corps of cavalry in consequence of Rennenkampf's offensive on Königsberg and was compelled later on to transfer still more forces in order to protect its Eastern frontier.

The important rôle of cavalry on account of its ability of rapid action was shown by the operations of Polish cavalry in the 17th century. particularly hetman Czarniecki exploited ingeniously this characteristic of cavalry. "*Movement and rapidity is all with Czarniecki. Hence his army at times is composed exclusively of cavalry, the weapon of rapidity and movement; often having artillery and infantry he leaves them in a fortress, or in a strengthened camp*

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and with cavalry alone, unsupported with guns, without transport marches against the enemy with a view to surprise him and to defeat.'' *Kukiel.* The wars of Sobieski who fought at the head of small detachments of cavalry against the Turks and Tartars who outnumbered his troops tenfold—are an unexhaustible source of examples of this lightning use of cavalry.

''The considerably more rapidly executed strategical moves of the Russians in 1866 impeded the freedom of movements of the Austrian army which was at that time being concentrated to that degree that it was compelled to start the fight under conditions greatly inconvenient from a strategical point of view.''—von Bernhardi.

The adequate understanding of this factor caused the employment of motor-car-columns, so usual in the Great War, and which served for great transportations of troops.

This factor has a still greater importance, when applied in combat *''Der schnelle Sieg ist eine höhere Potenz des Sieges, die späte Entscheidung bei der Niederlage ein Ersatz für den Verlust.''—Clausewitz.*

A victory gained in a short time, despite great losses, has this attribute that it raises the spirit of the conquering troops, affecting the beaten armies in an opposite way, which effect is produced then much more strongly than in the systematical and slow retreats.

The rapid victories of the Polish hetmans and those of Napoleon and Frederic while paralysing the opponent's will in addition to the defeat of the enemy's army allowed them to conclude soon an advantageous peace; on the contrary the English victories in the Transvaal of Lord Roberts, and the Japanese victories in Manchuria gained slowly and with great difficulties did not in a serious way affect the beaten armies. But a rapid victory may be gained merely by rapid and decided action; Napoleon's campaigns are an example of it.

The Great war on the Eastern front displayed a series of rapidly gained and brilliant victories: only to mention Soldau, Gorlice, Brusilow's offensive, Riga, etc.; during the Polish war Vilno, Mozyrz-Kalenkowicze and finally our counter-offensive before Warsaw. A deep analysis of the Polish-Bolshevist war will explain the above mentioned Clausewitz's sentence about the influence which a rapid victory exercises on the soldiers' soul; (e.g. the swing of the Bolshevist offensive after the breaking of the Polish 1st army's front, as well as Polish counter-offensive).

This psychological factor insufficiently appreciated in the Great War has a particular signification for armies which possess a character akin to militia and such were both the red army so diverse as regards its nationality, training, and armament, from the Polish army whose detachments often were composed of recruits having received a training of a few weeks.

Similar conditions under which the importance of this psychological factor was particularly displayed, we find in the wars in which the armies of the French Revolution took part and when the hungry

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and bare-footed detachments under the command of young generals conquered the perfectly trained, regular troops of the Austrian, Russian and German Armies, as well as the Boer war when, in order to protect their independence the former planters and merchants took up the arms and during a long time fought obstinate, often victorious, battles with the regular and well disciplined English troops.

Thus may be explained the difficulty of stopping the Bolshevist Northern offensive by demoralised and badly trained soldiers after the breaking of the Polish 1st army's front; in this way too may be explained the swing and rapidity of the Polish counter-offensive after its successful start.

The Russo-Japanese war, on the contrary, is a classical example of military operations executed slowly on both sides; the Japanese did so because of the innate characteristics of their race: slowness and cautiousness, the Russians on account of their constant lack of initiative and decision. Thus may be explained the partial victories of the Japanese army gained over the vanquished, demoralised and constantly retreating Russian army. *"D'ailleurs malgré toutes les bonnes raisons invoqués, la lenteur a bien été la caracteristique principale de la strategie japonaise pendant toute cette guerre de Mandchorie."—Gen. Mordacq.*

Analogical examples of this slow action, though more injurious in their results, we find in the history of the Polish-Russian war in 1830-31. From these examples the most characteristic of all is Skrzynecki's expedition from Warsaw.

Although this expedition, prepared with the greatest secrecy in a massing of all available forces 130 battalions, 46 squadrons, 70 guns, ingeniously worked out and planned by Prondzynski chief of the General Staff was crowned with two victories: at Dembe Wielkie and Iganie in consequence of an unexplained behaviour of the cunctator Skrzynecki who failed to arrive at the right time with the main force, so that Rosen was able to withdraw with his endangered corps to Siedlce, in its decisive issue it had no concrete results.

It was perhaps one of the best occasions for a decisive battle with the divided forces of Dybicz the Russian commander in chief which were considerably weakened by the last Polish victories and which battle would have perhaps affected the latter course of war and therewith the political situation of the country.

A rapid and decided pursuit after gaining victory over the enemy is one of the principal axioms of the art of war *"Aber für alle denkbaren Verhältnisse bleibt es wahr, dass ohne Verfolgen kein Sieg eine grosse Wirkung haben kann und dass wie kurtz auch die Siegesbahn sein mag, sie immer über die ersten Schritten das Verfolgen hinausführen muss." —Clausewitz.*

According to this author a pursuit may have three forms: the throwing forward small detachments of cavalry, the use of the advance guard composed of all three main arms with a large number of cavalry —finally the pursuit carried out by the whole army.

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The outcome of a pursuit depends on its rapidity as well as on the forms then used.

The wars of the past centuries, above all Napoleon's campaigns furnish many examples of this highest form of pursuit which is the pursuit of the whole army; the wars of the XXth century e.g. that in the Transvaal, or in Manchuria give no examples in this respect. In the Russo-Japanese war, especially, we observe a lack of a rapid and intensive pursuit, which may be explained by the characteristic of the Japanese strategy, the slowness of action.

Doubtless, after the battles of Mukden and Laojan the application of a less intensive form of pursuit (according to Clausewitz's classification), namely the throwing of several brigades of cavalry together with horse artillery in a pursuit after the demoralised Russian detachments retiring in disorder would have changed their confused retreat into a panic flight.

In the records of the Polish-Bolshevist war, namely in the Kieff offensive, we find a similar example of a pursuit slowly executed.

It is admissible to suppose that a pursuit executed more energetically combined with an action of a greater force of cavalry on the right flank of the Soviet army retiring under the pressure of Colonel Rybak who, alas, commanded only two regiments of cavalry (not counting one regiment of the Tartar cavalry of 100 men)—would have led to the cutting off of the line of retreat and to the complete defeat of the surrounded Soviet army.

The application of pursuit reached its highest forms in the Great War; as well as the counter-attack it is ordered in all instructions of the fighting armies.

Evolution in tactics consisting in the idea of a complete dismemberment of the opponent's army has in view the exploitation of the division for the purposes of pursuit.

In small battles which bear a tactical character, as well as in great strategical operations applying concentration and surprise on an extensive scale—pursuit, in case of success, is the integral part of each attack.

Thus may be explained the numbers of prisoners of war, machine guns and cannons captured after successful operations.

Only to quote the repeatedly above mentioned operations: among others, one of the most important, the German offensive in 1914 and 1918, as well as the French counter-offensive which brought to the Allies about 280,000 prisoners and about 4,000 guns, an enormous trophy, and which compelled the German High Command on the Western front to sign the capitulation; further on the Italian front the battle of Caporetto and the pursuit giving to the Austrians and Germans 350,000 prisoners and 3,000 guns, half the Italian artillery, and a big stretch of land from Isonzo to Piave.

The Eastern front which was more movable displayed still more examples of strategical pursuit; the most important are: in 1915, after the battle at Gorlice the continuous pressure of the Austrian-German

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army on the retreating Russians; the operations in Rumania which ended in the defeat of the Rumanian army; and therewith the acquisition of unexhaustible supplies of naphta, cereals and raw materials and the possibility to maintain a close touch with the near East; Brusilow's offensive which lasted 6 days was crowned with the capture of 106,000 prisoners and 124 cannons and compelled the Austrians to withdraw their 11 divisions from the Italian front and the Germans to recall their 8 divisions from the French front.

In the Polish-Bolshevist war a pursuit carried out according to the order of our Chief Commander : "*we must win this battle entirely with the legs and courage of our infantrymen*" in addition to a complete defeat of the Soviet army which was operating against Warsaw resulted in the capture of 70,000 prisoners, 200 cannons, 100 machine-guns and a large quantity of military stores.

This pursuit carried out on a large scale, with trifling losses on our side e.g. the IV army which captured 25,000 prisoners lost about 500 men, was one of the greatest combats in our history.

The little studied war of Wrangel with the Bolsheviks in 1920 gives too an example of a pursuit executed on a large scale and crowned with a decisive victory.

After the breaking of the front line at Kachowka on the 29th November 1920 by Budienny, the Bolsheviks' pursuit (after a short pause before Wrangel's Termopiles) by means of continuous attacks by concentrated and selected troops of infantry and artillery broke the weak defense and like an avalanche burst into the peninsula driving the remainder of the white army before it.

Even a superficial analysis of the over mentioned factors : surprise, rapidity, concentration, shows their evolution and importance in the history of wars; in order to avoid repeating we shall limit ourselves to an assertion that the future war, independently of the forms which it may assume, will abound in examples of an energetic application of these principles.

The development of the military technique and the evolution of tactical doctrines afford a substantial evidence of it.

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A CRITERION FOR THE SIGNIFICANCE OF DIFFERENCE IN RANGING, ETC.

BY LIEUT.-COL. R. K. HEZLET, C.B.E., D.S.O., R.A.

WHEN the question arises as to whether some slight difference in design between two shells will appreciably affect their ranging, the usual practice is to fire a comparative trial with the two varieties and compare the mean ranges realized in the two series.

If an appreciable difference in the mean range results it is then of importance to be able to form an opinion as to whether the difference is really due to the difference between the two varieties of shell, or is a merely casual difference due to the magnitude of the probable error in the determination of the mean of each series.

Similar questions also arise in connection with other measurements in Experimental Ballistics such as muzzle velocities, times of burning of fuzes, and so on.

These are all particular cases of a problem which frequently arises in Statistics, and is sometimes referred to as the "Error in Sampling."

The "Computer's Handbook"[1] states the problem in the following way—"The means of two samples are more different than was expected, can their difference be due entirely to chance or is there some genuine cause for it?" (sec. V, p. 24).

It also observes in this connection that "The usual tendency of mankind is to assign a cause for purely casual differences, or to use the differences to support some preconceived idea."

The Handbook explains how to answer the above question, and the subject is also discussed at greater length in Yule's "Introduction to the Theory of Statistics" (p. 345 et seq.)

That, if certain precautions are not observed, there is a danger of erroneous conclusions being drawn in such cases, is brought out by the following example.

Table I. shows the results of a series of 20 consecutive rounds fired from a gun under as nearly as possible the same conditions.

[1] Issued by the Meteorological Office.

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Table I.

Round.	Range. Yards.	Round.	Range. Yards.	Round.	Range. Yards.
1	5922	8	5895	15	5892
2	5902	9	5872	16	5920
3	5904	10	5924	17	5922
4	5923	11	5923	18	5962
5	5782	12	5874	19	5883
6	5880	13	5877	20	5887
7	5888	14	5952		

If we now take the odd and even rounds in this series and group them separately and take the means we get

Mean Range of odd rounds = 5887 yards.
Mean Range of even rounds = 5912 yards.

a difference of 25 yards.

This is an appreciable difference and the incautious or inexperienced experimenter might deduce that there must be some causal reason for it. We can even imagine that supposing for instance the odd shell had been painted green and the even ones pink, and the results taken as that of a comparative series fired "round for round," a general theory might be started that pink shell outranged green, and no doubt some theorist would be found to propound a so-called "explanation" of this curious and interesting ballistic phenomenon.

In reality the difference has not necessarily any causal signficance, and this can be checked by an easily calculated criterion which will now be given for the general case.

As a measure of the dispersion it is customary in Statistics to use the *standard error*[1] (or *mean square error*), but in Ballistics the *average error* (frequently referred to simply as the *mean error*) is more usually employed, and the formulae will consequently be given in terms of the latter

---

[1] Suppose there are n observations

$$a_1, a_2, a_3 \quad - \quad - \quad - \quad - \quad a_n$$

and that

$$x_1, x_2, x_3 \quad - \quad - \quad - \quad - \quad x_n$$

denote the departure of each observation from the arithmetic mean of the n observations, then the *standard error* or *mean square error*, σ, is given by

$$\sigma = \sqrt{\frac{x_1^2 + x_2^2 + \quad - \quad - \quad - \quad - \quad x_n^2}{n}}$$

while the *average error*, or *mean error*, ξ, is given by

$$\xi = \frac{x_1 + x_2 + x_3 + \quad - \quad - \quad - \quad - \quad x_n}{n}$$

the absolute values of the x's being taken without regard to sign.

In the limit $\sigma = 1{\cdot}253\xi$.

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Let n_1, n_2 be the number of observations in the two series, ξ_1, ξ_2, their average errors. The required criterion is that *unless the means of the two series differ by more than*

$$(1). \qquad 3{\cdot}75 \sqrt{\frac{\xi_1^2}{n_2} + \frac{\xi_2^2}{n_2}}$$

the difference is not necessarily significant.

If the same value ξ can be taken for the average error in both series (1) reduces to

$$(2). \qquad 3{\cdot}75\,\xi \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$$

while if in addition the number of rounds n is the same in both series (2) further simplifies to

$$(3). \qquad \frac{5{\cdot}3\,\xi}{\sqrt{n}}$$

Applying (1) to the odd and even rounds in Table I, we have

$$n_1 = n_2 = 10$$

mean error of odd rounds, ξ_1 = 27 yards
mean error of even rounds ξ_2 = 24 yards

$$3{\cdot}75 \sqrt{\frac{\xi_1^2}{n_1} + \frac{\xi_2^2}{n_2}} = 3{\cdot}75 \sqrt{72{\cdot}9 + 57{\cdot}6}$$
$$= 3{\cdot}75 \times 11{\cdot}42$$
$$= 43 \text{ yards.}$$

so that the observed difference of 25 yards has not necessarily any causal significance.

Let us take another example. Table II. shows the result of two ten round series fired under as nearly as possible the same conditions except that the external contour of the fuzes differed.

Table II.

(A) Round.	Range. Yards.	(B) Round.	Range. Yards.
1	9864	1	9728
2	9928	2	9764
3	9818	3	9726
4	9941	4	9706
5	9978	5	9774
6	10062	6	9669
7	9930	7	9785
8	9892	8	9672
9	10008	9	9726
10	9994	10	9779
Mean Range	9942	Mean Range	9733
Mean Error in Range.	55	Mean Error in Range.	34

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Here the difference in range is 209 yards while the criterion works out at 77 yards, so that in this case we are dealing with a real difference in ranging due to the different shape of the fuzes.

As a third example take the data in Table III which again shows the results of two ten round series fired under as nearly as possible the same conditions, except that the fuzes in the two groups differed very slightly in external contour.

Table III.

(A)		(B)	
Round.	Range.	Round.	Range.
1	19318	1	19500
2	19279	2	19536
3	19209	3	19294
4	19179	4	19593
5	19508	5	19565
6	19494	6	19557
7	19544	7	19664
8	19593	8	19650
9	19616	9	19499
10	19614	10	19635
Mean Range	19435	Mean Range	19549
Mean Error in Range.	151	Mean Error in Range.	74

Here the difference in the mean range of the two series is 114 yards, but as the criterion works out at 199 yards the difference in ranging in the trial is not necessarily due to the difference in contour of the fuzes but may be merely a casual difference. The only way to obtain further evidence would be to repeat the trial several times and to see if a fairly consistent difference was obtained in all the trials.

If this was the case the average difference might be accepted as the average result which would be obtained in practice, but it must not be forgotten that in individual shoots random fluctuations about this average are bound to occur, and should not cause surprise or distrust. No multiplication of trials or increase in the number of rounds in a series with the idea of establishing a more "accurate" or "reliable" table of differences in ranging can have any influence on the occurence of these random fluctuations in future shoots, although the accuracy of the average figure arrived at may be improved in this way up to a certain limit which for practical purposes is soon reached.

The above examples which are all taken from actual firing results and so are in no way imaginary or fictitious will perhaps serve to illustrate the danger of basing any tables on insufficient data.

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The criterion given, if intelligently used, will be found a very useful check in all such problems as a safeguard against hasty generalizations from inadequate evidence.

Where the number of rounds in the two series is the same, (3) is a more convenient form than (1) for a rough estimation, and may be employed for this purpose, which is frequently all that is called for, taking for ξ a mean between the average errors of the two series. With the aid of a few tabulated values of $\frac{5 \cdot 3}{\sqrt{n}}$ little more than mental arithmetic is then required for the calculation. Thus for 5, 7, and 10 round series ξ has only to be multiplied by 2·4, 2·0, and 1·7 respectively to arrive at a rough estimate of the criterion.

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THE READY USE OF TRIGPOINTS IN MOVING WARFARE.

BY MAJOR M. R. C. NANSON, R.G.A.

ARTILLERY tactics require much shooting without registration, and any systems, which may be adopted with satisfaction to obtain the initial line with exactude and simplicity, are of particular interest for those who command the longer ranging guns, because the error on the target caused by faulty line increases proportionately to the range; that which also stimulates the desire to get a good line in the initial laying out, is the possibility that the arc of the guns, limited by the position or the platform, may not enable line to be tested by an air burst on a distant object, the map position of which can be identified and relied upon, such as a Church spire or Factory chimney.

If the high velocity of the gun, and the nature of the fore-ground permit of testing line on a short range object with a ground burst, it still is not entirely satisfactory, for it is necessary either to be nearly plumb on the line in observing for line, or to expend enough ammunition to get a shot which is range, for otherwise, the pluses or minuses, considerable for a high velocity gun, will upset the judgement of the line: moreover, errors of line, which would arise from a false position being taken for a short range target, will be greater than those which will arise from an equally false position of a long range target. Hence, a long range ground target is much to be preferred to any other for the purpose of testing line; but then arise, the difficulty of finding a suitable one and the increased difficulty of observing.

Now, in order to test the line with an air burst on a well defined long range target, such as a known spire sticking out of a wood, it is necessary, that the observer is observing from near the line gun-target, a possibility which does not always occur.

The value of long range guns depends on accurate line, whether to enfilade a route or a ravine, or whether to silence an enemy battery.

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Some of its targets will admit of errors or range, but none errors of line. The shooting of the guns for range can, moreover, be tested periodically, and the muzzle velocity will probably fall off fairly uniformly with the rounds expended, but the line must be obtained accurately for each position. The line then is rightly the greatest anxiety of the battery commander; moreover, correct line is a help in obtaining correct range by flank observation.

In moving warfare, the fixing of the correct initial line depends on the correct fixing of the position of the director, and this is done accurately by a resection with a director, and less accurately by resection with plane table, the resection in each case being obtained from 3 trigonometrical points, churches, etc. Now, it is a remarkable fact that it is very much easier to find a position roughly on the line of 2 trigonometrical points, than it is to find one from which 3 trigonometrical points or churches are visible, and it can be shown that it is possible to find an accurate line from only 2 trigonometrical points without accurately fixing the position of the director. By accuracy is meant with an error of not more than 2 minutes, generally, and not more than 5 minutes, on any occasion, so that, when shooting takes place under moderately well known weather conditions, an error of about 10 minutes might be expected. Actually, the writer employed during the advance period of the war the system to be described.

Magnetic compasses never inspire confidence; the survivors of these, though apparently reliable, may not be so, and he who relies on a compass must have a faith in its reliability, for though he may believe and trust in this, he cannot be certain of it.

Under the 2 point system, what was done was, to tick off on the map the churches which were given in the lists of those with tabulated co-ordinates, to note where the line joining any two of these passed high ground near the battery position, and to study the map to ascertain the possibility of seeing these churches from such high ground. As a rule it was not necessary to go far, and a very short time elapsed before a director was well nigh on this line, ready to bear on these churches and also on a point in or near the battery.

The angles between these three points are read; that between the two churches should be greater than 160 dgrees if the director is in between them, and probably less than 10 degrees if it is in prolongation of them. The distance of the director position from one of the churches is measured from the map, and for this to be done the position of the director is obtained with such accuracy as alignment on local detail and paced, or estimated, distances from near features will allow. Though this last is rough, it is well to measure the distance to the church off the map with dividers as accurately as possible; the smaller the scale the more important does this matter become (on a scale of $\frac{1}{20,000}$, 10 yards is represented by $\frac{1}{50}$ of an inch).

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By stepping with the measured length on the dividers down the grid until a coincidence with one of the sub-divisions of the grid is obtained, and by then sub-dividing the total length, stepped, by the number of steps taken, we obtain this measurement nicely on a small scale map.

The data, thus obtained, is now brought into use by employing the sine formula of the solution of triangles.

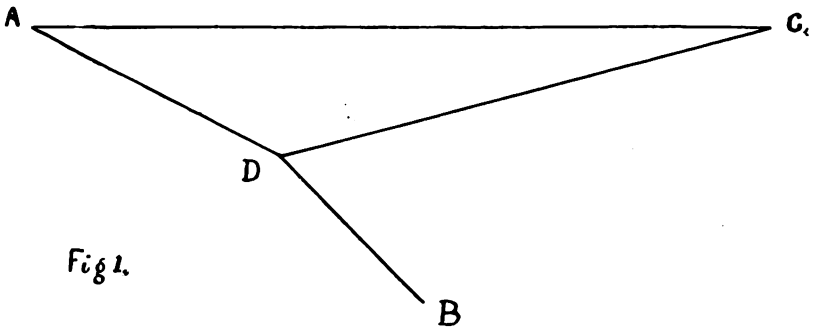

Fig 1.

In Fig. 1, A and C are churches, D is the director, B is the battery, AD is measured from the map, ADC and BDC are measured with the director, AC is computed or measured, and the bearing AC is computed by the well known method from the co-ordinates of A and C. The angle at C is obtained from the formula :—

$$\text{Sine C} = \text{sine } (180 - \text{ADC}) \times \frac{\text{AD}}{\text{AC}}$$

This formula may be solved quite accurately on the slide rule, or logarithms may be used. The angle C is applied to the bearing CA (for this figure, it is subtracted). The angle BDC is then applied (for this figure, it is added). The result is the bearing BD from the battery to the director.

One would like to know the degree of accuracy which may be obtained from this method of obtaining line, and in order to test this, two examples are taken, for each of which two churches are taken as being 10,000 yards apart.

In the first example the position of the director is taken as equidistant from each church, while in positions successively displaced from the line joining them by 100, 200, 300, etc. yards, indicated in the figures by D1, D2, D3, etc. In the second example the same displacements are taken from a point $\frac{1}{4}$ of the way down the line joining the churches. (See Figs. 2 and 3.)

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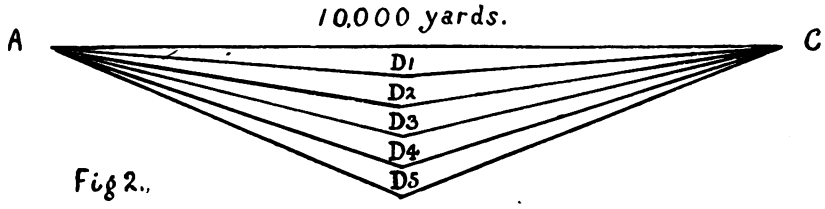
Example 1. (See figure 2.)

1	2	3	4	5	6	7
Displacement of D from A C.	A D in yards.	Angle A D C.	Angle at C.	Error from 100 yds. in A D.	*	*
100 yards.	5001	177° 42′	1° 09′	01′	nil.	nil.
200 yards.	5004	175° 26′	2° 17′	03′	nil.	nil.
300 yards.	5009	173° 08′	3° 26′	04′	nil.	nil.
400 yards.	5016	170° 52′	4° 34′	05′	nil.	nil.
500 yards.	5025	168° 34′	5° 43′	06′	+01′	nil.
1000 yards.	5099	157° 22′	11° 19′	15′	+14′	nil.

Fig. 2.



* Note.—Less than 0·5 of a minute is put down nil.

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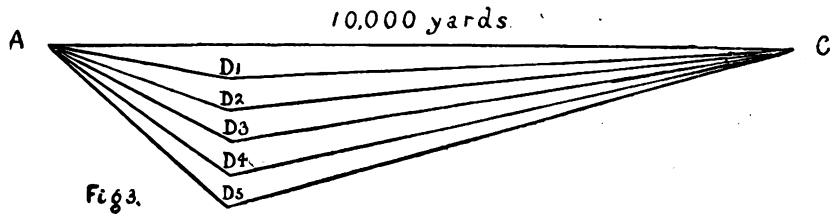
Example 2. (See figure 3.)

1	2	3	4	5	6	7
Displacement of D from A C.	A D in yards.	Angle A D C.	Angle at C.	Error from 100 yds. in A D.	*	*
100 yards.	2502	176° 56′	46′	02′	nil.	nil.
200 yards.	2508	173° 52′	1° 32′	04′	nil.	nil.
300 yards.	2518	170° 53′	2° 17′	05′	nil.	nil.
400 yards.	2532	167° 52′	3° 03′	07′	+01′	nil.
500 yards.	2550	164° 53′	3° 49′	08′	+02′	nil.
1000 yards.	2693	150° 36′	7° 36′	17′	+19′	+8′

Fig. 3.



* Note.—Less than 0·5 of a minute is put down nil.

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The tables show the angles at C, in column 4, corresponding to the data in columns 2 and 3; column 5 indicates the errors which in these examples would arise owing to an error of 100 yards in the length of the side AD. Columns 6 and 7 show the errors which would arise, if approximate arithmetical formulæ were used for calculating the angle C instead of employing the trigonometrical (sine) formula.

These arithmetical formulæ are :—

(7). C in minutes $\frac{AD}{AC}$ of (180 - D) in minutes.

(6). C in minutes $\frac{AD}{AD+DC}$ of (180 - D) in minutes.

The latter requires the measurement of DC on the map.

If a slide rule is employed, the trigonometrical formula involves less labour than either of these. There are, however, conditions of failing light or other inconvenience, when one relies more readily on ordinary arithmetic than either on slide rule or logarithms, and it is on this account, that these formulæ are inserted in this article.

The bearing of the line AC must, indeed, be worked out, unless some chart or table, indicating the information, has been provided, but one or more assistants can be turned on to this job, and made to check each other, or may be, this has been done in anticipation during a period of comfort.

In considering the value of this system in comparison with that of obtaining the line from the director's position and only one trigonometrical point, or church, it is well to realise that an error of 100 yards in the position of the director in the latter system may cause an error in line of 69 minutes at the distance CD of example 1, and 46 minutes at the distance CD of example 2.

If there should be a third trigonometrical point, or church, visible, we have data for computing the position of the director in co-ordinates with accuracy, and in a simple matter; also, for obtaining those of the battery by further measurement with tape or short base.

It may sometimes happen that only one church, or point of given co-ordinates can be seen from the high ground near the battery, but that proximity can be obtained to the line joining this church and another church, or point, definitely shown on the map, but for which no co-ordinates have been given. It is probable that this church is more accurately placed on the map, than it will be possible to place the director on it. In this case, it is considered that it is sound practice to measure the co-ordinates of this church with needle-pointed dividers from the grid, making use of the refinement in measurement which has been described above. The co-ordinates thus obtained may then be employed in like manner to those tabulated.

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ARTILLERY INTELLIGENCE AND COUNTER BATTERY WORK.

BY MAJOR BT. LIEUT.-COL. C. N. F. BROAD, D.S.O., R.F.A.

DURING the late war the Artillery intelligence service and the counter battery staff were two distinct organisations, although they dealt with one and the same subject—the defeat of the enemy's artillery.

In the early days they were so separated, that they were of little assistance to one another.

As the war progressed, they drew nearer and nearer, until they finally worked in very close co-operation, and practically became one service. The creation of the Artillery Survey companies has finally joined them together.

Counter battery work probably provides the best example in the Army of close co-operation between Operations and Intelligence. All fighting intelligence must be red hot, and hardly a shot is fired from the operations branch of the counter battery office, the reason of which cannot be seen at a glance in the intelligence branch. Furthermore should the intelligence branch collapse, counter battery work practically ceases.

Counter battery work, tactically speaking, was very much neglected during the war, except by those immediately concerned with it. To the majority of officers it was practically a closed book.

When people do not understand an organisation, they can do little to help it, and counter battery work needs all the help it can get from every possible source.

The average infantry or field artillery officer in France knew little of the science of counter battery work. He knew nothing of what went on behind him when the heavy shell were passing over head. He heard them continually droning above him, but as that always went on, it called for little comment. He knew less of what the shell were aimed at, or why. During the war this was largely unavoidable, but in peace time it is necessary to reduce this apathy by education and propaganda for two reasons :—

(i) Moral.
(ii) Mutual co-operation.

Knowledge and realization of our own strength always increases our moral. A demonstration of the system in a counter battery office was generally a complete revelation to a battalion commander. He was then able to tell his men about what was continually being done, night

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and day, to defeat the enemy's guns; and also to explain the difficulties of the work and the reasons why it cannot always be effective. Then failure to stop the enemy firing was not put down to callousness or inefficiency, and mutual esteem resulted.

From this stage a desire to give assistance will develop, since the value of it, and the possible results to be obtained from it will be realized, and mutual co-operation will be greatly improved. As I will show later, reliable information about the hostile shell on landing is of great value in dealing with the gun that fired it.

Counter battery work is a tactical operation which is actively continuous day and night, whenever the opposing forces are in contact. The same offensive principles govern it as other operations.

It can be divided into two phases.

(i) The continuous offensive against the hostile artillery designed to undermine the moral and efficiency of the enemy's gunners, and is, in effect, a never ending attack against the whole hostile artillery resources. This offensive may be aimed more particularly at either the enemy's moral or his material. This is a matter of policy which must be laid down by the Higher Command.

In France it was the enemy's material which was the main objective of the continuous offensive. It is on record on the authority of General Ludendorff that in one month in 1918, the Allied counter battery work destroyed 13% of the German guns on the Western front.

(ii) The other phase is the attack of the hostile artillery during battle with the same object as all other artillery work at this period i.e. putting the infantry on to the objective with as little loss as possible.

Before the late war, artillery in covered positions was practically immune from hostile artillery fire.

Numerous instances can be quoted both from the Russo-Japanese War, and every phase of the late war, of the paralysing effect of modern gun fire on infantry, when the circumstances have been such that counter battery work was either non-existant or ineffective.

As the Artillery came to take a larger and larger share in the fighting, it became essential to counter its fire. Various means to this end were envolved.

They were as follows :—

(i) Artillery Sections, Field Survey Battalion, now the Artillery Survey company.
(ii) Royal Air Force.
(iii) Counter battery office.
(iv) Artillery intelligence organisation.
(v) Counter battery communications.

A thorough grasp of the capabilities and limitations of each service is essential before the study of counter battery tactics can be commenced.

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Artillery Survey companies contain three units :—

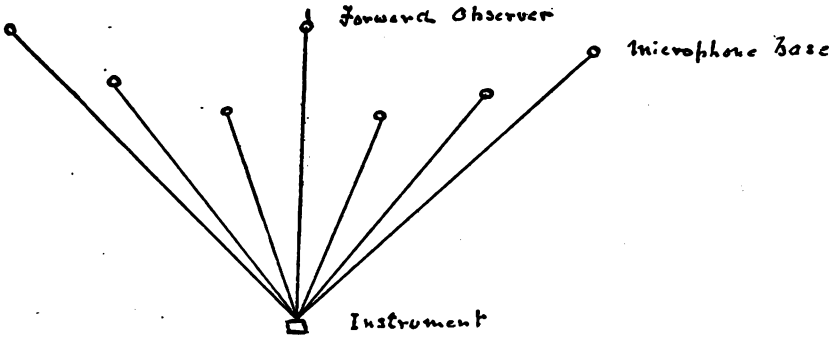
(i) Sound ranging detachments.
(ii) Observation groups.
(iii) Compiling Offices.

The object of Sound Ranging is to locate a hostile battery by means of the sound wave which is made by the piece being discharged.

It can also be used to range our own batteries by locating the burst of each projectile.

A sound ranging detachment consists of 3 officers and some 75 men providing three reliefs for both apparatus and linesmen. The apparatus consists of 6 microphones, or automatic detectors, connected to a timing apparatus.

The latter is set in motion by a human observer called a "forward observer" in an "advanced post", so that the sound waves reach him a few seconds before they arrive at the microphones.



The forward observer is usually some 1000 to 1500 yards in front of the microphones, in some spot where the hostile artillery is heard to the best advantage.

The microphones for technical reasons, should be placed behind the main field artillery line.

The position of each microphone has to be surveyed very exactly as an accurate knowledge of the relative positions of the microphones to each other, combined with the times the sound takes to reach each microphone successively, is the essence of the whole apparatus.

The surveying of the microphone base and the laying of the necessary connecting lines are the two factors which may cause the installation of a sound ranging detachment to be a somewhat lengthy affair.

In a well mapped country, a base can be quickly laid out; and, as a temporary measure, cable can be laid instead of erecting air lines. In this manner a detachment can be placed in action in 24 hours, although, as a general rule, it is not worth while to order a sound ranging detachment into action unless a halt of 48 hours is expected.

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The instrument itself is placed well back for the following reasons :

(i) It is delicate and expensive, and therefore has to be out of the shelled area.

(ii) Good weather proof cover is required for both the instrument and the computers.

(iii) Personnel engaged in paper work in which meticulous accuracy is essential must work under decent conditions.

The sound waves produced by the discharge of the hostile artillery and the bursting of the shells are heard by the microphones and recorded by the instrument on a piece of photographic printing paper. From it can be worked out the position of the piece and the locality of the burst thereby establishing a shelling connection.

Sound ranging also gives a good deal of information regarding the nature of the piece which generally leads to correct deductions as to its calibre. This information is usually very difficult to obtain from other sources.

In France these detachments were placed all along the front to meet two general considerations :—

(i) They were placed directly opposite if possible, the main groups of hostile batteries, as the best results are obtained when the line of microphones is at right angles to the line of fire.

(ii) It was also necessary that they should overlap so that the batteries placed between the main groupings should not be missed.

From this the reader will see the necessity of centralised control, as the positions of the detachments depended on the enemy's artillery groupings and not any corps or other boundaries we chose to make. The front covered by a sound ranging detachment is usually about 8000 yards. It can only function at very small angles beyond this base on both sides.

Sound ranging suffers from several limitations.

(i) An adverse wind will usually prevent all action.

(ii) Heavy shelling tends to confuse the record, and lengthens the time taken to work out the results. With the regular base, now in use, the shelling must become very heavy before work becomes impossible.

(iii) The long lines are very vulnerable and once installed cannot be moved, so that it is necessary to look well ahead and possibly forecast events before putting in a detachment.

The time taken to work out a record varies from 5 minutes to half an hour according to its difficulty. Once located the officer dealing with the records can often recognise a battery immediately the paper comes off the machine, so that very prompt and accurate neutralization is possible. For this purpose a battery or batteries are affiliated to sound ranging detachments in order to take advantage of opportunities of catching the detachment at their guns. All activity is at once reported to the C.B.S.O. together with any action taken.

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As regards the Observation Groups.

The object of these is to locate hostile batteries by means of intersections by visual observations on their gun flashes.

The group consists of a headquarters and a varying number of observation posts working as a unit. Each post is manned night and day, and is located in some commanding spot. High up and some way back is the best place to see flashes and if convenient hills or church towers are not available structures are built in high trees.

Each post has a spotting instrument with a graduated arc and is connected by telephone with its headquarters. The latter consist of the telephone exchange and a plotting board on which the positions and arcs of each observation post are accurately plotted.

The chief difficulty in action is to ensure that all the posts working together as a unit are operating on the same flash. Special measures are taken to ensure this, so that very accurate trisections and even quadrusections are sometimes obtained.

Observation Groups are much quicker to instal than sound ranging detachments, and can even function continuously in semi-mobile warfare. Under good conditions, they can set up and start work in 6 to 8 hours.

They can function to a great distance on a clear night, but are dependant on suitable ground for the best results. Their installation is subject to somewhat the same conditions and requirements as sound ranging, but the frontage is only limited by the necessity of getting good intersections.

Neighbouring posts of adjoining groups can always be brought in for this purpose.

The headquarters can be well up with the posts if time is not available to lay long telephone lines.

Neutralization etc. is carried out in the same manner as with sound ranging.

Both flash spotting and sound ranging can be used for ranging our own guns but it is not advisable to do this as a rule with sections that are used for intelligence purposes; as by doing so valuable information may be missed.

Other posts, if available, can be installed for the purpose and good results obtained.

As regards the compiling Office :—

During the late war this was located at Army Head Quarters. In future, it is probable that each Corps will have its own compiling office under the control of the C.B.S. O.

Its object is to examine all photographs of the counter battery area and accurately to plot the position of every actual or suspected gun emplacement in the area. It is really the authority for position.

The Compiling Office and the Artillery Intelligence Office are in very close touch, so that it is hard to make an exact division of their duties.

Broadly speaking, the Compiling Office is responsible for technical

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accuracy from the Survey point of view while the Artillery Intelligence Office is concerned with the technical artillery point of view and for making deductions from the information supplied.

There is of course a lot of common land in between which they traverse together; the technical artillery and technical survey knowledge thus brought together enabling a true course to be steered.

The nature of their work make the officers in the compiling office the photographic experts as regards battery positions.

The results of the Observation Group and Sound Ranging detachments are tabulated and examined in the compiling office and activity charts are prepared either by this office or the artillery intelligence office as a general check on hostile artillery activity.

Under the 1918 organisation two very important documents were prepared in the army compiling office.

(i) The hostile battery position list. (See App. I.)

APPENDIX I. CONFIDENTIAL.

Cancels all previous lists. List No.....

——— Army.

LIST OF HOSTILE BATTERY POSITIONS.

R.—denotes Ranging Pit. Date.

Zone No.	Co-ordination.	No. of pits.	Calibre.	Last active.	B.Cs columns.
KD					
52	K29 D 57.94 ..... 56.84 R	2	77m	...	Strength gun placements Photo.
83	K35 a 16.54 R 17.50.....	2	105m How.	...	Occupied & unoccupied, etc.

Major-General,
G.O.C., R.A. ——— Army.

(ii) The Counter battery map.

Both are kept up to date as much as possible and renewed whenever required, according to the changes in the hostile artillery.

The hostile battery position list shows every hostile battery position known on the Army front. It is not a list of hostile batteries, but of places where they are or may be. Particulars are given about each battery position which may be useful to battery commanders for shooting purposes such as the exact map co-ordinates of each pit, the strength of the emplacements, photos on which it is shown, etc.

Some distinction is also usually made in the style of printing between those battery positions thought to be occupied and those thought to be unoccupied.

This list is therefore for artillery use and is the bible of a battery detailed for counter battery work. All the batteries in its area are carefuly marked up on the fighting map from the co-ordinates given in the list.

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The counter battery map is usually printed on I/20,000 scale and is a specially prepared map with detail not clear from the air fined down and other detail shown up. The map in fact is primarily for use in the air and is made to stand out clearly. All the battery positions which have been active lately are shown on this map in a clear manner —usually in black. The chief point to notice is that the battery positions are marked on this map exactly as they appear to the eye. Thus a battery may be situated in a hedge running off a road—the four pits are shown in the positions in the hedge which they appear to occupy from the air i.e. according to the photo, and marked with the zone number.

It is quite possible, however, that the hedge or even the road may be incorrectly marked in, on the map, so that from the battery point of view the real position of one of the pits may be in the middle of the road; this being the real spot on the ground as given in the list. This would be unsuitable for the air observer as his map and the eye would not agree.

These two publications are entirely distinct and it is dangerous to mix up their issue, one goes to the R.A. and the other to the R.A.F.

This brings us to the part played by the R.A.F. in counter battery work.

Three units are used, viz :—

(i) The Corps Squadron R.A.F.
(ii) The Long range gun flight R.A.F.
(iii) The Balloon Wing R.A.F.

The Corps squadron does the greater part of the counter battery work. It has three flights, two of which are usually detailed for artillery work, while the third is employed on photographic work.

The remainder of the work, which is not so great in volume nor so continuous, being fitted in between the flights.

It is important to recognize the smallness of the corps squadron, as this greatly limits the amount of artillery work that it is able to do.

If possible, the interior organization of the Heavy Artillery in a Corps is made to fit in with the squadron organization, i.e. two artillery flights, so that the whole control can be decentralised by means of direct dealings between flight commanders and subordinate artillery commanders.

The squadron maintains an artillery patrol in the air during daylight. This means several machines in the day, especially in the summer. This patrol is of great value as it is a great source of information as regards activity i.e. which positions are occupied. This information is sent down by means of the N.F. call which is taken in by all wireless masts and thus goes direct to the C.B.S.O.

It is also the duty of the patrol to examine the area and endeavour to locate new flashes or new positions together with any other artillery information which may be of value. The pilot uses his judgment as to the amount which he departs from his proper rôle, to engage hostile batteries or other targets seen.

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Information is required about all natures of targets as this patrol is an artillery patrol not a counter battery patrol only.

The other main counter battery duty of the artillery flights is the observation of destructive shoots. In France these shoots were the most important counter battery task. The policy, as regards the hostile artillery, was a relentless attack which was practically continuous. The R.A.F. observed shoot was the chief means by which this policy was carried out.

All that these observers are asked to do is to locate correctly the burst of each round and wireless it to the battery. Certain preliminary arrangements are essential to success. The observer must be given time to study the photo of the battery or batteries he is going to engage, and the pit most clearly distinguishable from the air should be selected for ranging upon. Furthermore the observer wants to know the position of the battery ground strips, by means of which the battery communicates with the plane, and also the calibre and mark of the battery together with the charge, so that the time of flight may be looked up. The observer requires this in order to be certain he is locating the right burst.

When actually observing, the plane flies in an elipse between the battery and the target.

The observer cannot keep his eye upon the target all the time, and moreover parts of the plane will obstruct the view during various portions of the elipse.

Hence it is vitally important that the gun should be fired immediately the observer gives the order.

The breaking of the windows of motor cars passing in front of batteries during the war was, needless to say, due to the observer's order; and not to any desire on the part of the batteries to shake up the august ones inside!

The return half of the elipse is utilised by the observer to wireless his observation on the last round.

The two artillery flights thus do all the observation from the air, and provide good information as regards activity. In actual practice in the war the pressure of work on these flights was so great, and always will be so, that the duty of intelligence is apt to take a rather bad second place. This deficiency is made up by the work of the photographic flight. This forms the basis of all counter battery intelligence.

The photograph is the eye of the counter battery artillery. From it may be obtained, in a complete manner, almost every thing which is collected piecemeal from other sources; and moreover in not nearly so accurate a manner.

On the photograph, position is absolutely accurate. It is almost impossible to hide a battery from the camera, however good the camouflage.

The camera will fail only when :—

(i) The position is completely masked by foliage.
(ii) The personnel never visit the battery.

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(iii) The dumped ammunition does not spread beyond the foliage or other complete cover.

The indications produced by blast marks, tracks, etc., forms first class evidence of activity when the photograph is in the hands of an expert.

Photographs are of two kinds, operations and reconnaissance. The former are used for actual shooting and considerable detail is required. They are not usually taken at over 10,000′ though cameras of greater focal length enable them to be taken at greater heights with approximately the same detail, but not always with the same definition. The latter are used for photographic reconnaissance of probable reinforcing areas or any artillery reconnaissance of that nature. They may be taken at 17000′. In this class of work a greater area with less detail is usually required. It is therefore necessary to state the approximate height required when photographs are ordered, always bearing in mind that photographic machines run considerable risk from enemy aircraft. The importance of the work must always be gauged against the probability of disaster when ordering low photographs any distance beyond our own lines.

The reconnaissance photos are perhaps used chiefly by the Artillery Intelligence at Army Headquarters who require to look ahead, and endeavour to forecast the enemy artillery operations. The Corps counter battery office is more occupied with the intelligence immediately connected with the actual fighting in progress.

The frequency with which photos are required in a stabilised battle varies according to the operations in progress. On a battle front new photos are required after any move on the enemy's part and in addition at normal intervals of about 3 days. This amounts to some hundreds of photos in a short time and entails an immense amount of work in connection with them, the organisation of which will be dealt with later. The speed with which a photograph can be taken, printed and distributed to the actual fighting unit is a matter of prime importance.

In order to expedite the delivery of the more important copies a primary and secondary issue is generally ordered. The primary copies can be distributed in a few hours, the secondary copies following the next day.

In France a normal primary isue of a counter battery photo was as follows :—

(i) Squadron R.A.F.
(ii) C.B.S.O. (2 copies).
(iii) Corps Artillery Intelligence.
(iv) Army Artillery Intelligence.
(v) Compiling Office.

Each squadron is provided with a "squadron artillery officer." In heavy fighting it may be necessary to have two officers as the duties are twofold.

(i) Intelligence.
(ii) Operations.

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The S.A.O. is the link between the C.B.S.O. and the observer. It is his duty to see that every atom of useful information is obtained after each flight. To this end he interviews all observers after landing, with the maps and photos, in order to check the information that has been sent in by wireless, and also to examine the observer with a view to finding out any further details regarding the hostile artillery generally.

He is in constant touch with the C.B.S.O. by telephone and attends all the C.B.S.O's conferences.

The A.O. had other duties to perform in connection with the actual shooting. He generally assists the squadron commander in allotting his resources to the work which has to be performed, as the demands are often in excess of what can be done.

He also visits the batteries and investigates failures, which are otherwise likely to cause lack of confidence on both the part of the B.C. and the observer.

When casualties are frequent and the observers young and inexperienced, he is also used to instruct them, so that they may have some knowledge of the causes that affect shooting and what the battery requires of them.

The Army Wing R.A.F. does no artillery work except photographs beyond the squadron line. These are either reconnaissance photos or special work for spotting the locations of long range artillery. This latter work can also be done by the special flights attached to the Corps Wing Headquarters. These flights would be used for this long range counter battery work when undertaken and in many respects it is better that they should take any photos required.

They are equipped in a special manner for their highly dangerous task. They have fighting machines of the first class as they have to observe many thousand of yards inside the enemy's lines. Sometimes they are protected by special patrols provided by the Army Wing R.A.F., but it may not be possible to do this always. The machines are fitted with a wireless receiving set as well as a sending set, so that it is not necessary to return to the battery to read the ground strips. The battery has also to be specially equipped with a sending set. All sets have to be of a long range type suitable for the work. These flights only work with the long range guns, so that a very high degree of personnel liaison is possible between the guns and the observers.

There is an A.O. at Corps Wing Headquarters and his functions regarding these special flights are similar to those of a squadron artillery officer. He also deals with the artillery staff at Army Headquarters and generally supervises the squadron artillery officers.

Balloons are organised in a Wing consisting of a headquarters and a varying number of balloon companies. Each Army in France had a wing and each corps a company. The company consisted of usually two and sometimes three sections, each section having one balloon with its personnel and transport.

The section was really the fighting unit. The company and

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wing headquarters being really administrative and training units; the wing being in close touch with the army and the company with the corps.

I mean by this that all operations work passed straight from the balloon to the fighting unit or military staff concerned and did not go through the company headquarters, although the latter was of course responsible for the technical efficiency of the balloons and their personnel in every way.

It is often thought that anyone can go up in a balloon and observe. This is by no means so. Balloon observers need a careful training in order to be as efficient as aeroplane or ground observers; in fact it is much more difficult to observe from a balloon than from an aeroplane. The specialities of map reading have also to be learnt and the art of using glasses in a balloon. The latter is a good deal easier nowadays than it was with the old unstable balloons.

The work of balloons is almost entirely connected with artillery. It is incumbent on them to report general information when obtained in the same manner as other units. In Europe troop movements cannot be seen from balloons except in very large numbers, so that information of this kind is rarely obtained from them and does not justify the use of special balloons for this purpose.

In the East the situation is often entirely reversed. In Palestine, in times of good visibility, it was possible to see single Turks at 6000 yards; small bodies of troops and vehicles could be seen at much greater distances.

In any case the moral effect of balloons is very great. They are credited with absurd powers of vision. I do not refer specially to this but rather to the way in which they advertise the advances made to the whole line. From any eminence the line of balloons can be seen for miles, and is a visible and tangible picture of the success of the victors and of the straights in which the vanquished have been placed.

Their real work and that for which they have been organised is counter battery intelligence and observation of artillery fire.

Shoots are arranged in much the same way as with aeroplanes. Balloons however have the advantage that the observer can talk to the officer commanding the guns all the time; the balloon is in fact only a glorified observation post.

All natures of guns can be ranged on targets in the forward area, but at longer ranges balloon observers find difficulty in ranging unless there is something definite to range upon, such as a hedge; so that the targets require carefully selecting.

The intelligence obtained from balloons is limited to N.F's, which, of course, can be seen with great ease. The observer is on a comparatively steady platform high enough to overlook all flash cover and very little should escape him. Difficulties however come in when he tries to make out the exact map square of the active hostile battery. His observations are bound to be inaccurate unless there is something definite to give him a guide, such as wood or hedge. All the same,

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they are able to send in a lot of accurate information and furthermore produce a lot of confirmatory evidence as regards activity in certain localities which can be more accurately located by other means, such as photos.

This ability to locate active hostile groups of batteries is of particular value at night.

Balloons can send out N.F. calls if required like an aeroplane, in which case they are treated in the same way.

When communications stand, certain batteries are usually affiliated to balloons so that shooting can commence at once, and catch the hostile detachment at the guns.

This is particularly useful in the case of enemy balloon guns. The observer in the balloon sees the flash and between that and the arrival of the shell he has plenty of time to ring up the battery concerned and get a shell back. If the enemy balloon guns are a nuisance they can be kept quiet by this method as casualties will be inflicted at the guns and balloon chasing ceases to be a pleasant afternoon sport! Balloons have great difficulty in doing accurate night work as they cannot say exactly where they are, so that any rays taken by them are somewhat unreliable. Good work has been done at times, but it cannot be depended upon.

Balloon communications are a somewhat complicated affair. They usually have a forward exchange in the battery area from which lines radiate to the people concerned. The personnel of balloon units are not very numerous so that, as in the case of observation groups, sound ranging, etc., they have to be helped out by the heavy artillery signal section—very often assisted by the Corps.

Balloons are quite mobile and do not advance through telephone lines regardless of other peoples communications as commonly supposed! The balloon advances best inflated and can be warped over obstacles on the ground such as telegraph lines, without doing any harm or blocking the road. In fact fewer gas lorries are required by this method.

It does not take much imagination to see the use to which balloons can be put in open warfare provided they are in really close touch with the artillery: so many other sources of information having disappeared for the moment.

In order to get this close touch, balloon sections have been affiliated to heavy artillery brigades. The balloon is thus relieved of all communication responsibility except the line from the balloon bed to the heavy artillery brigade exchange, which in open warfare need not be long, as the balloon can approach much nearer.

The balloon then flies over its own artillery brigade and does observation and intelligence work in that brigade zone.

(To be continued).

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"DUNCAN" COMMENDED ESSAY, 1921-22.

BY MAJOR & BT. LIEUT.-COL. H. G. DE WATTEVILLE, C.B.E., R.G.A.

"Deduce from the experience of War, the future of the defence of Coast Fortresses against Attacks by land, sea, and air, during the next ten years."

"SUB UMBRA."

SECTION I. INTRODUCTORY.

1. *Foreword.*

The present state of Europe, the results of the Washington Conference, and an urgent need for national economy are gradually reducing coast defence to a dormant condition.

It may, therefore, be accepted that no change or innovation in the existing system can even be contemplated unless such a step will lead to reduction of expense. The skilful utilization of present resources and a reasoned modification of accepted tactical methods thus remain the only processes whereby any improvement can now be achieved. But scientific and mechanical progress, more particularly in the sphere of aviation, may be transforming every aspect of the question long before the close of the ensuing ten years. In addition, the obstacles to forecasting the needs of coast defence are accentuated by uncertainty as to future national policy and its dependent scale of military preparedness. So the discussion of tactical or technical issues seems to verge on unreality, if not to evade a practical solution.

On the other hand, the possible creation of a Ministry of Defence might lead to an overhaul of current ideas regarding the protection of the national territory, and the problem of home defence would begin to assume renewed importance. Consequently, it may be more opportune to approach the theme of coast fortresses from the broader standpoint of national coast defence. Such a treatment not only appears to answer more nearly to actual needs, but will also be found to be the true outcome of the teachings of the recent war.

2. *General principles affecting British coast defence.*

Coastal fortification has always suffered acutely from the evils inherent in passive defence. Fixed works can only be designed to meet certain hypothetical forms of attack which are in fact ever subject to change. Further, the plan and armament of any permanent fortification begin to grow obsolete from the day of its completion. The maintenance or transformation of such structures is costly, whilst the need for instant readiness demands the provision of adequate and skilled personnel. A period of rapid progress in technical resources only intensifies those defects. All these facts point to the following conclusions:

First; the system of coastal defence adopted by a maritime power, such as Great Britain, is so closely bound up with national

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policy and strategy, that it is highly susceptible to modifications dependent on the nature of any war which may ensue from that policy.

Secondly; land armaments, just as much as sea-going ships, are deeply affected by scientific and technical progress and may soon become obsolete.

Thirdly; national finance and resources in men and material must influence the extent to which the passive defence of the coast may be developed at the expense of mobile combatant forces designed for action on the sea, by land, or in the air.

During the XIXth century, so long as slow moving navies and armies of low offensive efficiency prevailed, these axioms could be disregarded. Coastal fortification remained simple and was lavished on every naval port. These ponderous creations could justly be named "Coast Fortresses." But the introduction of armoured ships and rifled ordnance heralded great changes. So the Naval Defence Act of 1889 was followed by a redistribution of the armament and troops assigned to coast defence. The armament and garrison of every defended port were revised on a fresh scale, much reduced but proportionate to the importance of each.

Nevertheless, the title of coast fortress was allowed to persist, though it was obvious that the defences as then reconstituted were incapable of dealing with a squadron of modern "ships of force." That disparity would have been greater if a regular land siege were to be initiated against one of these so-called fortresses. Such an eventuality was, however, ruled to be utterly improbable in the face of our armed maritime supremacy. British superiority afloat was to replace any extravagant system of passive defence on shore. Coast defences were designed to repel "raids" alone.

3. *Coast defence in the early XXth century.*

Such was the position when the imminence of the German challenge became manifest. In this coming war the narrow Straits of Dover were still to form a pivot of British naval strategy, but instead of the traditional menace coming from over the Channel, there was substituted the new enemy across the North Sea. It was no longer the south coast that required defence, but our longer, more difficult eastern shores. Some insight into the subsequent evolution of those eastern defences seems essential to the comprehension of the present theme.

As early as 1903[1] the need of naval bases situated on the North Sea coast had been felt, and it was decided to create a new base at Rosyth. But in 1908 the increasing power of torpedoes made it clear that its outer anchorages was exposed to destroyer attack; so the defences had to be reconsidered. Even then Rosyth would not serve. By 1910, therefore, Cromarty began to be regarded as indispensable for an advanced temporary fleet base, and Scapa Flow as one for minor forces. Nevertheless, by 1912 naval developments had reached such a pitch that both Cromarty and Scapa Flow were seen to require fixed defences.

[1] The following lines are a précis of certain passages in Sir Julian Corbett's "Naval Operations," Vol. I., Chapter I.

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A new series of difficulties was now encountered owing to other developments in naval material. Consequently, the scale of attack, according to which coastal defences were planned, became "a shifting foundation on which it was almost impossible to build." In the Humber, where new establishments had recently sprung up, the defences, now of little use, had to be redesigned. But by the time estimates had been prepared, the proposed defences were no longer adequate, for the enemy might well elect to risk obsolecent battleships in coastal attack. So the work had to be begun again on a new and higher scale. Similar considerations applied to all defended ports. Still the process of evolution did not end here, for at this period submarines began to obtrude themselves. By the end of 1913 the sea-going submarine had to be taken into most serious account. Though Cromarty could easily be rendered proof against the new craft, the very nature of Scapa Flow rendered it doubtful whether the work was worth the cost.

There were other thorny points besetting the question, particularly such as arose out of differences between naval and military views of what constituted adequate defence, also radical divergences as to the danger of military attack. This trouble was overcome in the case of Cromarty by handing it over entirely to the Navy. From the first this had been desired by the Admiralty in order to ensure the necessary degree of elasticity with which the function of the port might be adjusted to immediate naval needs. By the end of July, 1914, the whole of the fixed defences at Cromarty were complete. In the Humber, on the other hand, the new heavy armament had not been begun, whilst Scapa, except for local territorial artillery, was without defence of any kind.[1]

The development of coast defence in the Dominions and Colonies had followed identical lines. As long as the potential enemy resided in Europe, the reasons actuating our defence policy held good. It was, however, growing clearer, from the close of the Russo-Japanese war onwards, that great fleets were coming into being in distant waters. Fresh naval problems with concomitant questions of coast defence would consequently arise. But at this period the German menace riveted all attention : so the coast defence of the Empire was considered from that standpoint alone.

SECTION II.

THE EVOLUTION OF COAST DEFENCE IN THE GREAT WAR.

4. *British coast defence at the outbreak of war.*

On the outbreak of war, all our coast defences, maintained for five previous days in a state of "precautionary" readiness, were mobilized. The eastern coast was patrolled by coast-watching troops, chiefly composed of cyclist battalions. In East Anglia two mounted divisions of Yeomanry were in addition allotted to the task. But the brunt of the attack, in the event of invasion, was to fall on the territorial divisions, formed into a mobile central force for the protection of London and the Midlands.

[1] This closes the précis of the passage taken from Sir Julian Corbett,s book.

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The Royal Flying Corps, yet in its infancy, could scarcely satisfy the needs of the Expeditionary Force. The Royal Naval Air Service was only coming into existence. On the side of passive aerial defence things were little better. Some anti-aircraft guns, mostly of low efficiency, had been mounted at a few naval stations.[1] So it was without aerial support that our coast defence organization awaited its first trial.

In advance of the military armaments, the Royal Navy from the outset had contributed for purposes of coastal defence a volume of armed force demanding detailed notice. The 6th, 7th, 8th and 9th "Patrol" flotillas of destroyers with their attached light cruisers,[2] were allotted to Dover, the Humber, the Tyne and the Forth respectively. Five flotillas of older submaries, exclusive of the old "A" class boats retained for local harbour defence, were also allotted to that organisation. Lastly, a few recent light cruisers, two destroyers and the "overseas" submarine flotillas were formed into an active force based on Harwich. To repel naval raid or invasion, Great Britain thus depended on three lines of defence :—First, the patrol and other flotillas of the Royal Navy : secondly, the garrisons of the defended ports linked by intervening coast-watching troops; thirdly, the central force. In front of this triple line there loomed up the more distant Grand Fleet, which might, however, possibly require some 24 to 48 hours before it could appear on a possible scene of action.

As the campaign dragged on, one consideration after another introduced slight modifications into this system of defence. But to the end its underlying principles never changed.Coast defence was primarily the care of the fleet and coastal fortification was but a subsidiary instrument designed to afford the fleet greater freedom of movement. Throughout the war the navy and the army were ever prepared to work in unison. The birth of the Royal Air Force only admitted another partner to a share in the burden.

Our naval preparations and the march of political events surprised the enemy, robbing him, perhaps, of the chance of attempting a stroke, regarded for years almost as the classic opening of future naval war. The first German movements were neither preceded nor accompanied by any nocturnal torpedo raids against British warships or harbours. The anticipation of such a surprise was the outcome of the Japanese success against the Russian fleet lying in Port Arthur on 8th February, 1904. It had led to years of sedulous training with light Q.F. guns on the part of British coast artillery. The opportunity of testing this form of defence seemed to have vanished.

5. *The bombardment of the East Coast by German "ships of force."*

On 3rd November the German battle cruiser squadron and subsidiary ships appeared off Gorleston and Yarmouth and engaged a few of our light craft. The engagement was brief and the enemy soon disappeared. Although no shell fell ashore, the incident showed that our coast could not be considered immune from a serious raid.

It was not until 16th December that the same ships appeared off Hartlepool and severely shelled the town and works of defence,

[1] These had been allotted to naval ports only—including Plymouth—and even a pom-pom for Barrow-in-Furness.

[2] These totalled to 5 light cruisers, 74 destroyers and numerous submarines.

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causing much damage to property and over 500 casualties. The batteries (3 6-inch Mark VII. guns) replied vigorously and escaped without a direct hit, even though attacked by a numerous and far heavier ordnance. The action lasted from about 8 a.m., to 8.50 a.m., and was fought at ranges of 4,000 to 6,500 yards: the weather was dull and misty.[1] A detachment from the same German squadron likewise attacked Scarborough, and later opened fire on Whitby, destroying property in either case.

The chief lessons of the affair are the concern of naval strategy. They show how a combination of circumstances, favoured by certain weather conditions, will enable a weaker fleet to attempt a raid against the hostile coast, even with heavy ships, and escape unharmed. The local destroyers and a submarine were engaged but failed in their attack on the raids. On the other hand, the low-profile, barbette battery had justified its design and shown its efficacy at medium ranges. Moreover, it transpired later that the enemy had suffered appreciable loss; that the *Moltke* had incurred many casualties, whilst the *Blücher*, in addition to killed and wounded, had emerged with two guns disabled. Still, it was clear that the civil population and buildings of all our seaside towns might suffer cruelly from any deliberate attacks carried out by any ships, not to mention obsolecent battleships carrying a heavy armament.

As the direct outcome of the action, the term "Fortress" was officially abolished and replaced by that of "Garrison," a more than superficial change, not only intended to allay public agitation as to why defences, bearing the title of "Fortress," had failed to protect civilian population and property. A broader outlook came to be taken of coast defence as a whole. A few 9·2 guns on railway mountings were brought out and moved along the coast wherever their presence seemed required.

Another sortie of the German battle cruiser squadron was signally defeated on 24th January by our own ships of a like nature near the Dogger Bank, where the German *Blücher* was sunk. The enemy took the warning to heart and did not again risk his bigger ships on coastal raiding during that year.

6. *The first German attacks by air against our coast defences.*

On 24th December a German aeroplane dropped a bomb in a garden at Dover. On the morrow another German machine flew up the Thames as far as Erith. Finally, on 19th January, 1915, two airships, L3 and L4, bombed King's Lynn and Yarmouth.

In April, Newcastle was visited by a larger airship, L9, navigated by a new application of radio-telegraphy, and the Tyne shipyards were bombed. This nature of attack grew more common. The ports of Harwich, Southend, Ramsgate and Dover were all attacked but suffered no real military damage. In August the gun defences of Dover hit the airship, L12, at night at 6,000 feet altitude. The stricken craft was destroyed by naval aeroplanes next day in Ostend harbour. The enemy was to become more chary of venturing on raids against defended ports, although they were never entirely discon-

[1] For the details of the whole action see Sir Julian Corbett's "Naval Operations," Vol. II., chap. ii.

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tinued. In September and October the raiders, neglecting the ports, visited London. The moral effect of these attacks always remained infinitely greater than the material damage. This phase of the war, however, being of little interest to coast defence, can be neglected.

7. *German submarine attacks against our coast.*

Another development of the naval war soon affected coast defence. Enemy submarines were beginning to attack mercantile traffic within territorial waters and were being sighted off shore. One raider, U.21, on 29th January, 1915, boldly appeared within 7,000 yards of Barrow-in-Furness, and fired on the airship shed. The 6-inch guns of the battery replied, but the submarine dived and vanished. Similar incidents were to recur. The Lowca benzol works at Whitehaven, Cumberland, were shelled, but escaped serious damage owing to the smoke of the benzol ignited by the first shell. Subsequently, Seaham in Northumberland received a few shells. Other attacks, such as the bombardment of a signal station on the Isle of Lewis, also took place. To the end of the war, the necessity thus persisted for all light fixed armament remaining ready for instant action by day and night.

8. *Necessary changes in coast defence tactics.*

The risk of torpedo-boat attack by night never disappeared. Coupled with the growing submarine menace, this fact rendered it desirable to keep all defence searchlights regularly doused at night, but to maintain the beams prepared for sudden emergency. Their constant exposure could only assist raiding craft in finding their targets. The increasing risk of aerial attack had long emphasized such necessity, and by June, 1915, enemy airships only ventured out on moonless nights. In order to hamper air raiders in finding their landfall or their target, it had been decided to conceal all lights visible from the sky. The obscuration of the ports, already put into force, was accompanied by the systematic darkening of the entire coastal region. With a view to eliminating the dangers of submarine attack, the procedure of the examination service was also changed. Incoming traffic was examined whilst moving inwards at speed, a procedure which, owing to navigational necessity, had already been practised on the Mersey. Greater reliance was also placed on boom and net defence. Many lesser harbours, used by mine-sweeping and anti-submarine vessels, such as Ramsgate, Lowestoft and Yarmouth, received anti-submarine and anti-aircraft artillery protection (one or two 12-pr., 4-in., or 4·7 guns), manned by naval ratings. Lastly, the minefield reappeared as an adjunct to harbour defence and was controlled by the Navy.

It followed from these changes that by the spring of 1916 coast defence had developed more from the naval than from the military standpoint. This tendency of relying on the Navy was increased by the difficulty felt by military gunners in identifying all types of novel craft—mystery ships, armed trawlers and drifters—as well as by the presence of minefields. Moreover, the need for an efficient system of naval intelligence on the coast led to the entire east coast being regarded more as a single entity in charge of the Navy. The

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defence of the ports was felt to be increasingly a naval matter, whereas military interests became more closely bound up with the defeat of invasion or land raid and of aerial attack. The aerial defence of the whole country, it was clear, must be centralized and placed under a single, central, control. This control, it was decided, must be military. Events were to justify this latter policy.

9. *The changes in the military system of defence.*

In 1916, the experience of war further strengthened the conviction that the most effective system of home defence lay either in preventing an enemy from landing, or in attacking him on shore whilst entangled in the process of disembarkation. Our fears of invasion may have been exaggerated, but this is a matter outside the present argument. Accordingly, the coast became an outpost line maintained for purposes of observation and information, whilst it was to form the main line of resistance. The fortification of all landing places on the east coast against landing attack was accordingly carefully completed, defended ports being considered more as fortified *points d'appui* in the entire defensive system. In addition to these duties, the coastal organization was embodied in the inland system for warnings of aerial attack. Lastly, it acted as an important security cordon for the prevention of all forms of illicit communication leaving the country.

10. *A last German aerial and naval attack on the coast.*

The German airship service had made vast progress during 1915-16. During the first days of April, 1916, various ports were attacked. Edinburgh was bombed, the raider shirking the defences of Rosyth, his true objective. Hull also suffered severely. Still these airships had their other uses. So it happened that the German battle-cruisers sallied forth on 16th April and hugged the Frisian Islands, skilfully covered by a screen of airships. Thence they made the East Anglian coast and shelled the towns of Yarmouth, Lowestoft and Southwold. The leading airships, meanwhile, bombed the neighbouring inland villages and towns.[1] This raid again served no material purpose and caused damage only to property.

11. *Coast defence policy after the battle of Jutland.*

On 31st May was fought the battle of Jutland. Whatever its tactical results may have been, its moral effect was such that no heavy German ship again came within range of our coast defences until they steamed into the Forth in their final act of surrender. The truly futile raids of the battle cruisers supply the clearest proof of the wisdom of the policy which maintained that our own maritime superiority would effectually neutralize all hostile fleets. Incidents such as the bombardment of the Hartlepools or of Lowestoft could indeed exercise no real influence on the war. The careful reduction in the scale of our coast defence in the past was fully justified. But though these raids were to cease, it was never understood by the public that no

[1] The operation is interesting, not only as exemplary of the aerial protection of a fleet, but also as being coincident with the the Dublin Rebellion—a typical application of the German philosophy of war.

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great enemy landing attack could ever materialize. It was imagined that the High Seas Fleet might recover from the blow, and it seemed as though the gradual depletion of England of trained soldiers might lure the Germans into one last bold attempt at invasion. Public opinion prevailed. In spite of the results of Jutland, it was thought necessary to secure the Tyne against long-range bombardment by means of an armament of 12-inch guns—a new departure. The Humber defences were also to be strengthened. The unique value of the Tyne on the East Coast, both as naval repair yard, and as a vital munition centre, was held to justify this measure.

12. *Coastal warfare in 1917.*

A further development of coastal fortification was taking place at this period. The increasing activity of German submarines had led to the convoying of coastwise traffic close in shore, and an anti-submarine system accordingly developed on land. Observation posts, hydrophones, electric lights and even guns were established at many places. Flamborough Head and the North Foreland, for example, received 6-inch Mark VII. armament.

In the meantime, the German destroyers, based on Ostend and Zeebrugge, began to raid the south-east coast by night. Dover was attacked, as well as Ramsgate, Margate and the Suffolk coast. But the defeat of one flotilla with the loss of two boats, due to the bold action of H.M.S. *Broke* on 24th April, 1917, made the raiders chary of venturing down channel or of lingering off shore after opening fire. No real damage resulted but only distress to the civil population. The enemy avoided the searchlights : his fire was wild and did damage only by reason of the size of the target, an entire seaside town. These raids are in fact devoid of real interest.

13. *The new aeroplane raids against S.E. England.*

The 25th May, 1917, witnessed the first appearance of the Gotha, twin-engined, biplane. On this date the German 3rd Bombing Squadron made for London. Defeated by cloudy weather, it turned back and bombed Folkestone, where many casualties occurred. Subsequently, Sheerness and Harwich were attacked. So far the raiders had suffered little loss. But in September, after losing two aircraft by gunfire at Sheerness, night raiding superseded day attacks. On 4th September 100 casualties were caused in the naval barracks at Chatham. But London remained the raiders' objective : the coast was never again attacked except by stray raiders passing in or out of the country. The raids proved of little military value and scarcely affected coast defence, though the moral effect, mainly in East London, was perceptible. The central control of aerial defence was finally to prove successful. But the noteworthy fact remains that the Germans only devoted a single squadron of large bombing planes to these attacks.

14. *The aerial campaign to the end of the war.*

During the winter of 1917-18 new "Giant" aeroplanes[1] also began attacking England. The objective remained London, though

[1] Large machines carrying 1 ton of bombs and belonging to the 501st Giant Areoplane Section stationed near Ghent.

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a concentration of effort against a smaller target on the coast, such as Harwich or Dover, might have achieved greater results. The raiding personnel was, however, declining in quality and lacked the nerve to attack even Dover by continuous relays. The attacks slackened from December, 1917, onwards until 19th May, 1918, when a final attempt was made on London. The last airship attack was made on 5th August, when the newest airship, L70, having sighted land some hours before dark, was brought down off the Norfolk coast by our aviators.

Another aerial phenomenon on the coast during this last phase was the torpedo-carrying seaplane. But the Germans only used these machines for commerce destruction and never near or against a defended port.

15 *Coast defence during the closing phase of the war.*

The diminishing number and quality of the home defence troops accentuated the importance of defeating any land raiders on the beach. So late as 1917 and 1918, concrete "Pill-boxes" were being erected along the east coast at all "tactical points." A strange lesson in coast defence is the comparison between these buildings and the Martello towers of a hundred years earlier, a true reversion to type.

Increasing reliance was gradually being placed on aircraft as a means of defeating a landing attack at the moment of its disembarkation. Aerial support was now regarded as an essential part of the defence. Home units of the Royal Air Force, were accordingly included in the general scheme for the protection of all ports and the entire coast alike. The most complete combination of all types of naval, military and aerial forces was now an accomplished fact for all defence purposes at any point on the coast.

The old conception of the coast "Fortress" was in fact truly extinct.

16. *Coast defence during the summer of 1918.*

One more anxious moment supervened when, in 1918, it seemed as if the enemy might reach the Channel Ports. Had the threat materialized, the possibility of raiding attacks taking place on the South Coast arose. Dover and Folkestone could also be bombarded from across the straits by heavy guns. There was, moveover, a chance of super-long-range ordnance being employed by the Germans to attack Chatham. Even Woolwich and Deptford would then lie within range of such pieces. But the crisis fortunately passed.

In contrast to the German lack of enterprise against our coasts, our own undertakings against Zeebrugge and Ostend in April, 1918, should be mentioned. These were the only serious blockship operations of the war,[1] and were successful. But it must be borne in mind that the Germans lacked adequate naval or aerial resources to detect and to defeat the raids before arrival. The incidents showed that, given a necessary degree of surprise, the skilful employment of smoke screens—not lethal or disabling gas, be it noted—and necessary determination, such operations are still practicable.

[1] The analogous German operations against Libau in 1915 are negligible.

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17. *The naval war in distant seas.*

So far the coast defence of the United Kingdom has alone been studied. In home waters the juxtaposition of the main fleets, and the presence of great aerial forces occasioned particular problems. Further afield, conditions varied and, consequently, the task of coast defence was of another kind.

On the outbreak of war German cruisers set about destroying our mercantile tonnage in far-off seas. Our coast defences could scarcely participate in the struggle. Moreover, all ports were not defended. Accordingly, the light cruiser *Königsberg* was enabled to destroy the old British cruiser *Pegasus* in Zanzibar harbour on 20th September, 1914. Two days later the notorious *Emden* appeared off Madras at 9.30 p.m. There, in spite of a battery of 6-inch guns, she opened fire on the petroleum tanks and set them alight. Satisfied with this exploit, she made off unharmed. A month later the *Emden* carried out another daring stroke. Disguised, she entered the unfortified harbour of Penang, surprised and sank the Russian light cruiser *Zhemchug*. These few episodes prove that some slender measure of defence remains indispensable at overseas ports in a war where commerce-raiding enters into the enemy's policy.

By the spring of 1915 the high seas were clear of the enemy, and our overseas defences were never troubled. Apprehension was felt that armed vessels, such as the *Moewe* or *Wolf*, might venture to attack a defended port. But, at this stage of the war, no raiding ship would care to attract attention in this way, and the raiders kept to the less frequented ocean routes.

18. *The siege and capture of Tsingtau.*

In the meantime the Allies in the Far East had reduced the fortress of Tsing-Tau, the German base on the Pacific. The siege was described by the British military attaché with the Japanese as "a text book example of this type of military operation." The Japanese first landed on 2nd September, 80 miles north of the place. The main body soon followed, for the allied maritime superiority was so complete that the transport and disembarkation of the expedition passed off without a hitch. On the 18th the siege of the place began and proceeded methodically until its surrender on 7th November. On 17th October, the Prinz Heinrich Berg had been taken. This height was important, for it afforded observation of both naval and land artillery fire. The blockading squadron achieved little beyond securing the besiegers by sea. Aircraft hardly entered into the operation.[1] The chief point is that the Japanese, mindful of Port Arthur in 1904, recognized the value of a commanding height for observation, realizing that the fire of ships against coast defences would prove ineffective without the establishment of this form of observation on shore.[2]

19. *The Gallipoli operations.*

The fall of Tsing-Tau was followed by the attempt of the Allied battleships to force the Dardenelles. The briefest reference to this

[1] The Germans possessed one Rumpler aeroplane: the Japanese used hardly any.

[2] See also Sir Julian Corbett, Vol. II. p. 174, for the bearing of this question on the Gallipoli operations.

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great undertaking must suffice, though it offers many lessons touching coast defence.[1]

The lessons to be derived therefrom first require to be qualified by important reservations. The allied enterprise was only rendered possible by the maritime weakness of Turkey. Further, the entire resources of Turkish coast defence had been concentrated on the Straits, since they represented a point of naval attack which was without alternative. The scale of the defence was consequently most ambitious, and the shore batteries mounted ordnance up to 14-in. calibre. Lastly, the defence had received every indication of impending attack and had spent weeks in preparing for battle. The allied operations were not, properly speaking, a siege and are strangely reminiscent of the situation in the Crimea sixty years earlier. Yet, in other respects, these operations possess a lesser value for the future. The combatant resources of both sides were in the opening stages, with very few exceptions, not of the most recent type.[2] The Allies began the attack with but six very mediocre seaplanes. Submarine craft were very few and at first only in possession of the attack. Gas was never used. The mines of the defence were primitive. The Allied land artillery lacked power.

20. *The course of the attack.*

There were three phases in the actual operations :—

(i) The reduction of the "outer forts."

(ii) Renewed attempts to destroy the works and minefields defending "The Narrows."

(iii) Support of the military landing attack.

The "outer forts" were reduced on 19th and 25th February by overwhelming fire from the ships. The latter possessed the advantages of numerical superiority, of easy targets, and of possible concentration of fire. The "spotting" of gunfire, though lacking in experience, was practised. Even so, the semi-obsolete Turkish works, though silenced, were not destroyed. In spite of inadequate training and fire discipline, the gunners clung to their works and fired at the ships when these moved in to decisive range. The bulk of the guns were actually destroyed by demolition parties, after the garrison had abandoned the works.

The attack on "The Narrows" ended in failure. The ships could no longer concentrate their fire : the reverse proved to be the case. The shore armament was far heavier, and the defending troops were gaining in skill and confidence. Two obstacles, finally, brought the enterprise to grief :—firstly, the protected minefields, secondly, the mobile concealed artillery. The latter prevented any attacking ship from anchoring or from carrying out deliberate observation of fire. The loss of three battleships by mines on 18th March caused the attacks to cease. It was then clear that land observation of the ships' fire and the silencing of the hostile mobile guns would only be attained by landing a military force.

[1] For a full account of these operations as affecting coast defence see Sir Julian Corbett, Vol. II.

[2] The only modern ships in the allied squadron of sixteen ships were the *Queen Elizabeth* and *Inflexible*. It is, however, probable that the medium armament of the older ships proved of considerable value in attacking the forts at closer range.

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The third phase of the operations opened with some increase of aerial resources on the side of the allies; it also saw the arrival of the first enemy submarine. Its principal lessons concern trench or siege warfare. Nevertheless, the landings of 25th April will stand out for all time as an example of the possible achievement of determined infantry in combined operations. The gunfire of the supporting ships on this occasion also prove that warships can, under favourable conditions of observation, and if undisturbed, contribute largely to the process of a disembarkation. Ample ammunition is, however, necessary, though the range of this support is bounded by the facilities of observation.

SECTION III.

THE LESSONS OF THE GREAT WAR.

21. *The general lessons of the war.*

Fresh with the experience of four long, strenuous, years of battle, history can be allowed to speak in no uncertain tone. It should, consequently, suffice to recapitulate in academic form the teachings of the campaign. Nevertheless, the general conditions affecting coast defence during those four years must first be defined.

Except during the Gallipoli operations, no coast defence system was ever severely tried. The speed of the modern warship, the rapidity of radio-telegraphic communication, the submarine, and, lastly, the minefield, paralysed all attemps at transporting land forces in the face of maritime superiority. Even the allied operations in progress at the Dardenelles were nearly jeopardised by a few hostile submarines. The German landings in the vicinity of Riga were possible only owing to the decay of the Russian fleet. The enemy's naval raids against the British coast, were of a precipitate nature and aimed solely at producing moral effect: no tactical object was perceptible either in their conception or execution. In coastal warfare, it must be remembered, aircraft were never utilized on any appreciable scale, except for our bombing of the German coast defences in Belgium; no employment of gas or of similar lethal compounds was made; not a single *coup de main* from sea-going vessels or from aircraft—beyond bombing raids—was attempted against our own ports. If these reservations be admitted, then the following lessons may be accepted. The conclusions contained therein must in many respects remain purely theoretical.

22. *Lessons affecting national policy and strategy.*

(i). Coasts, adjacent to waters where maritime preponderance is effective, do not require coast fortresses for their defence, since true maritime superiority alone is capable of procuring immunity from serious raid and landing attack. Against this view it may be urged that Gallipoli and Port Arthur held out for months—with different degrees of success. Two weighty reasons existed for this result:—first, these were in reality secondary operations of war; secondly, vast military resources were piled into either fortress. The analogy of recent land warfare is also illuminating, since it shows that land

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fortresses, too, have vastly decreased in value if they are unsupported by a field army.

The belief that Great Britain required none of the old-fashioned "Coast Fortresses" had, in fact, been accepted, but had been incompletely worked out long ago. The decision of the General Staff, taken in December, 1914, to banish this term from our defence vocabulary seems to clinch the argument.

(ii). Sporadic maritime raids against a hostile coast may still continue in the face of effective maritime preponderance.

Such raids can be carried out (a) by ships of force (b) by light craft (c) by submarines. The first type of raid will be confined as to its objective by the enemy's naval movements, but the operation will prove hazardous to the attack. The second type can only be a "tip and run" affair delivered, preferably by night, over the shortest route open to the invader. The last type should prove insignificant, but may take place against any part of the coast and at any moment.

(iii). In order to protect them against such minor incidents of war, sufficient justification exists for granting some measure of defence to certain ports, naval dockyards or greater munition factories. But the degree of fortification applicable to each case will fluctuate according to the dictates of policy and strategy. Popular outcry over the bombardment of a seaside town might have to be considered. Again, our own naval forces may be drawn away and thus expose our shores to attack. It was a traditional device of our XVIIIth century admirals to draw an enemy fleet from its lair by apparently inviting an invasion of England. To-day the speed of ships and communications have not eliminated but altered the problem.

(iv). Effective coastal defence on the "Fortress" scale would now seem to absorb a disproportionate volume of combatant and financial power. Such a course would only be justifiable where the point so fortified might be the only port or dockyard possessed by the defender. This state of affairs might possibly exist in the case of Great Britain, at Singapore and, in a far lesser degree, in the Mediterranean.[1]

(v). In spite of enormous maritime preponderance on the side of the attack, land forces remain necessary to reduce a true coast fortress.

(vi). In a war of any duration, the nature of a possible attack on British coasts will alter with the change in the balance of forces.

(vii). The coast defence of a superior maritime power becomes equivalent to protection against lesser forms of naval, military and aerial raid along the whole coast.

(viii). Coastal defences in distant seas become superfluous, only when the enemy's main naval force is contained and his "free" outlying units have been brought to book.

(ix). Overseas coast defence depends upon effective communication and intelligence for the prevention of enemy surprise.

23. *The tactical lessons relating to coast defence.*

(i). The tactical lessons are few and, mostly, somewhat uncon-

[1] According to the Washington Treaty, Hong Kong cannot be fortified beyond its present scale, which is low.

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vincing. The operations both at Tsingtau and Gallipoli occurred too early in the war, whilst allied attacks at Gallipoli suffered from lack of material, especially of aircraft. The older example of Port Arthur and Santiago de Cuba are somewhat out of date.

(ii). The reduction of modern coast batteries by warships was shown to be as difficult as ever. The semi-obsolete outer defences of Gallipoli were crushed by weight of ammunition, but the little works at Hartlepool were able to reply bravely to the German battle cruisers. Later, the modern system of defence erected by the Germans along the Belgium coast neutralized allied naval attack. The blocking of Ostend and Zeebrugge were particular enterprises that cheated rather than attacked the defences.

(iii). The practicability of landing an army *without artillery, ammunition, and impedimenta*, in the teeth of hostile opposition was shown to exist as always. The success of the allies in landing at the Dardanelles, it should be noted, influenced current opinion as to the feasibility of the invasion of England. It was too readily forgotten that no opposition was forthcoming at sea or in the air, also that the landing forces were unprovided with artillery, stores, or transport.

(iv). The necessity of land observation of naval and military gunfire in coastal attack was shown to be imperative. The lesson of 203-metre Hill at Port Arthur was again exemplified at Tsingtau; it might have shown the way through the Dardenelles.

(v). The risk from torpedo attack to ships attacking any form of fixed defence is still great. This was shown at Gallipoli and, in another way, on the Belgian coast.

(vi). The immense value to the defence of heavy, medium and even light mobile howitzer and gun fire was proved.

24. *The growth of the aerial arm.*

The belligerent air services were never properly employed in a great combined attack against a coast. The Germans indeed never, except once, sent more than nine airships or some thirty aeroplanes simultaneously over the English coast; these attempts were but bomb-dropping raids. Though conducted on a relatively minute scale, the German activity in the aerial war on the coast is worthy of close attention and can be classified thus :—

(i). Reconnaissance and photography of coast defences, dock-yards, anchorages.

(ii). Bombing attacks aiming at the destruction of ships, work-shops, stores.

(iii). Reconnaissance connected with combined operations.[1]

(iv). Making a landfall for inland raids.

The main deduction to be drawn from the whole aerial campaign is that to the airman the coast has little intrinsic meaning: it is but a topographical feature, after crossing which the detection of his presence becomes assured. The defence of a naval base or dock-yard against aerial attack thus stands on the same level as that of any other inland arsenal, camp or munition factory of proportionate

[1] It is more than doubtful if aircraft were employed for spotting gunfire by them off the coast.

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importance. There remains the one point that surprise is more readily attained on the coast and the attack is, therefore, easier. Notwithstanding this fact, the material results attained by bombing raids on defended ports were no greater than those realised against similar inland targets. The whole war goes to prove that the defence of a coast forms an integral part of the air defence of the whole country.

Inversely, coast defence will profit from the services of the aerial arm to no small degree. During the last two years of the war growing reliance was being placed on our Air Force to repel landing attack. The concentration on the East Coast of some hundred machines in the space of scarcely more than a like number of minutes might have proved the decisive factor in defeating any such attempt. Our slender resources in coast-watching troops would have been immeasurably strengthened by this assistance. And the future can only see the growth of this power. Heavy bombing machines to attack transports at anchor, torpedo-carrying seaplanes to deal with fighting ships, smaller bombers for steamboats filled with troops, low-flying aeroplanes for the enemy on shore, all covered by a force of light fighting machines: what more could the aviator desire?

SECTION IV.

BRITISH COAST DEFENCE IN THE NEXT TEN YEARS.

25. *The policy and strategy of coast defence.*

The future of British coast defence depends on the solution of three problems which, expressed in terms of naval strategy, are these:—

(i). The defence of the shores of the United Kingdom.
(ii). The defence of overseas naval bases.
(iii). The protection of overseas ports against commerce destroyers and raiders.

Thus considered, the value of every place which might be protected by fixed defences can be determined. But, before proceeding so far, it is necessary to analyse what nature of war British national policy might evoke. The future enemy may reside in Europe or overseas. Should he be found in Europe, and the tried strategy of the past be applied to this new war, we shall seek to secure the inviolability of the Straits of Dover. The brunt of the operations then fall either to the north-east or the south-west of the straits. If it be assumed that, for the next ten years, there is no need to fear serious naval enmity from the east, then the scale of our eastern defences can be reduced. On the other hand, if the threat comes from the south, the strategic conception of the XVIIIth and XIXth centuries holds good and the South Coast has to be protected. Our fleets would maintain their pressure on the enemy from the north or from the west, from the region of the Orkneys or the Scillies, as the case may be.

The defence of overseas ports and bases follows as a natural consequence to the above. The Washington Agreement has stabilized the situation, but should our maritime superiority in Europe decrease, then our coast defence may require strengthening in home waters.

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One minor point remains, the situation of south-eastern England in time of war. It must be admitted that the possession by an enemy of the southern shores of the Straits of Dover would expose Dover and Folkestone to long range fire, Chatham, Sheerness and Woolwich to super-heavy gun bombardment. The same proximity increases the risks of aerial attack on the home counties by reason of the shorter distances involved. These operations, however, no longer concern coast defence: the first is the equivalent of a land siege; the latter is a phase of aerial warfare.

The future coast defence required in the Mediterranean is a difficult problem, unfitted for discussion in this study. In theory, Gibraltar and Malta will require a higher degree of defence than is requisite in England, since Gibraltar might be compelled to withstand attack for at least five days, Malta for eight or ten, before being relieved by sea. Gibraltar, let it be noted, is far too cramped to admit of successful aerial defence.

The defence of lesser overseas ports against hostile raid follows the same principles. But here we stand on firmer ground, for the lessons of 1914 stand unchallenged. Given a similar type of possible attack, the scale of defence remains the same, irrespective of whether the enemy resides in Europe or overseas.

Finally, the scale of coast defence, required in distant regions to meet the exigencies of war with an extra-European Power, must be considered. Should the centre of gravity of naval activity be transferred to the Indian or Pacific Ocean, or into the Caribbean Sea, the scale of coast defence still depends on the degree of maritime superiority obtainable in those waters. If not attained at the outset, our fleet might require 8 or 10 weeks to enforce this result by battle. In the meanwhile, the need may be felt of a coast fortress capable of withstanding siege by sea and land for a corresponding period. The memory of Port Arthur comes to mind. But are we prepared politically, no less than financially, to undertake such a task? If not, the scale of defence adopted can bear no relation to strategic conditions and national policy must deal with the resultant situation. No middle course will avail.

Provided, then, that British maritime superiority is maintained, the need for coast fortresses in home waters no longer exists. Our future development of air power can only emphasize this conclusion. Overseas, however, the case is not quite so clear.

26 *The future system and organization of coast defence.*

Coast defence commands represent the strong points in a line of resistance against lesser raids. Under the rarest circumstances could they have to face any more serious attack. A coast defence command should, therefore, contain two elements:—

(i). The *permanent defence element* designed to repel such lesser raid or attack by landing parties as may elude maritime superiority.

(ii). The *transitory element* required to reinforce those points which naval superiority or strategy cannot for temporary causes adequately protect.

In order to obtain some flexibility in re-adjusting our defences in

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war, and to allow our slender coast defences to fufil their proposed role, the place of the coast defence command in the defence of the country requires definition. The relations between coast defences and all mobile forces, as well as aviation units, must be established. The question turns also largely; first on whether there shall exist a G.H.Q. (Home), secondly, on whether coast defences shall be subordinated to a field formation H.Q., or to any "area" H.Q. These questions cannot well be answered in this study.

Commanders of coast defences should remain military officers and be regarded as commanders of sectors in the scheme of coast defence. A naval assistant is required on the staff of any such commander of importance. An officer of marine artillery should command the "constant" fixed seaward armament and lights, whilst the mobile or railway artillery will remain a military charge. This latter personnel will supply the reinforcements for the heavy artillery in the field.[1] Heavy fixed armament could remain military.

Such a disposal of fixed defences is fraught with difficulty and cannot be discussed here, but the tendency to this end has been growing for years.[2] The aerial defence personnel required on the coast will be found by the Air Force.

In order to provide the staff for the organization and control of coast defence in peace and war, the old Home Ports Committee should be reorganised on a new basis. It must possess a permanent Inspector of Coast Defence (not of R.G.A.), supported by one artillery and one engineer officer of the general staff responsible for home defence, whilst the Naval and Air Staffs should each provide him with one officer. The Inspector will also require the assistance of one expert, familiar with coast defence problems, from the Royal Engineer Board and the Chemical Warfare Branch. Officers holding normal appointments in all these branches should be selected ex-officio for this duty. This personnel, on mobilization, remain as the technical staff to the authority controlling home defence as a whole.

The future relations between coast and aerial defence also require determination. The very nature of air warfare demands that coast defences should receive a due measure of aerial protection. But local defences can only be regarded as detachments of the active air defence force of the whole country. They must consequently remain subject to central control, which will co-ordinate the defence of the whole or any part of the country against heavy attacks. It must, however, be agreed to allot isolated squadrons, or machines, to local

[1] In 1913 Lieut.-General Sclater's W.O. Committee decided that coast artillery officers were to be regarded as a reserve for the field forces.

[2] In 1906 Capt. Bacon's Interdepartmental Committee decided that instruction in coast defence matters must be interchangeable between the Army and the Navy.

In 1913 Capt. Haggard, R.N., presided over a W.O. Committee which recommended that the whole problem of the examination service should be reconsidered on new lines. The Admiralty declined.

In 1914 the Admiralty took over the entire seaward defence of Cromarty and of Scapa. Later minefields were revived by the Navy. The examination service was taken over by them. Light "naval" artillery was mounted at "naval" ports. The war is one record of increasing naval responsibility on the coast.

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defences for artillery registration, reconnaissance, or the defeat of sporadic lesser raid. The speed of the aerial arm renders some dispersion of force less objectionable.

The scale of the infantry defence must be adequate to cope with raiding parties intent on acts of destruction. Machine guns, some of these being motor-borne, are recommended for the purpose. The raiders are not likely to be accompanied by artillery. Enemy parties landed from aircraft may soon have to be reckoned with, but such attacks would come from landward.

The security of our ports against acts of sabotage, espionage, illicit communication, or enemy propaganda, perpetrated by agents on board enemy or neutral ships, remains essential. The outbreak of the last war favoured us in this respect. Control of the civil population in a large coastal town may prove difficult and alone requires the retention of a military commander backed by an infantry garrison.

The scheme thus briefly outlined may seem complex,[1] but this flaw is inevitable in view of the teachings of the war. The main defects of our coast defence organisation in 1914 were the rigidity of the system then instituted, and the isolation of Coast Defence Commands. These faults should be eliminated.

The tendency to consider coast defence through Garrison Artillery spectacles was very marked and obliterated several issues at stake.[2]

27. *Coast defence tactics of the future.*

The future forms of attack on coast defence seem to be :—

(i). Combined operations of all arms and services for the capture of a naval base or of a port.

(ii). Casual or fleeting bombardment by ships of force.

(iii). Surprise bombardment by light craft or submarines.

(iv). Aerial attack aiming at the destruction of a naval or aerial base.

(v). Commerce destruction at the entrance to a defended port.[3]

Since attack (i) is impracticable in the face of effective maritime superiority, the coast defences of Great Britain need not at present be organized to meet such a task. Additional grounds exist for disregarding, not only attack (i), but also (ii), for there is to the east of England no navy capable of such enterprises, whilst to the south the configuration of the Channel offers no really safe naval base for large vessels to the east of Brest. Submarines, light craft, and aeroplanes, operating in the narrow seas may, consequently, be regarded as an adequate substitute for any exaggerated coast defence, so long as the

[1] See Appendix I.

[2] A Commander of a defended port should attend the Naval Staff College for some weeks—say six—and the Air Staff College for another like period before entering on his appointment. He should also take part in an annual Coast Defence Conference (largely instructional) and present at some siege or trench warfare exercises.

[3] This operation is, of course, chiefly maritime, but may involve attack on the examination service or the minefields &c. Such an attack took place at Liverpool when an examination steamer was sunk by a submarine under the guns of the supporting battery.

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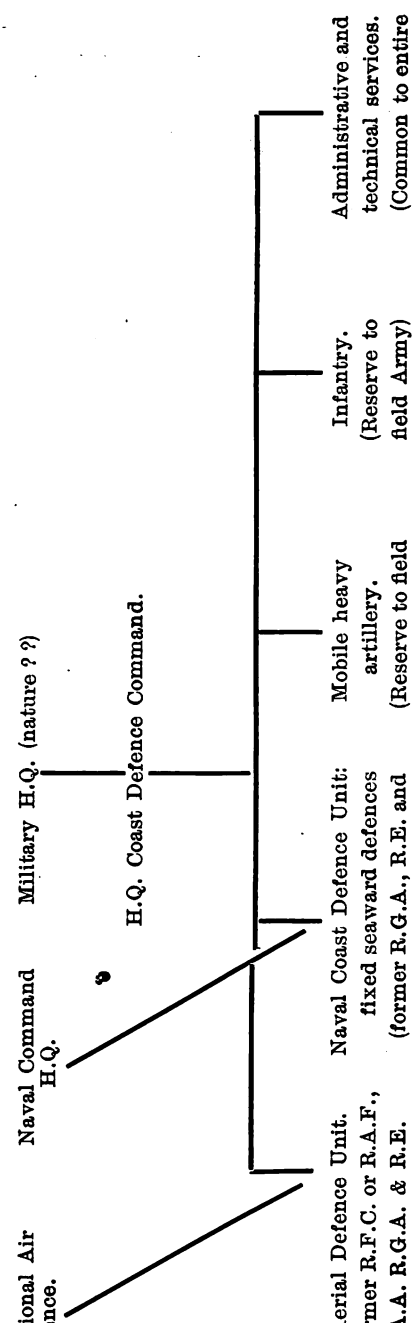
Appendix I.

Diagram of Coast Defence Command.



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ratio of naval forces is maintained according to the Washington Treaty. Still, the outbreak of war might find this country at a temporary disadvantage and some measure of defence may have to be ordered for that reason.

But attack (iii) must constitute a permanent menace to British coast defence so long as the enemy's bases lie at any distance from England which is within the capacity of such craft. Some defences at certain ports must, therefore, be maintained in proportion to the risks inherent to each and arising from exposure to enemy attack. Attack (iv) must be dealt with by the aerial defence of the country. Attack (v) is a slight variant of (iv).

In meeting naval raids of type (iii), fixed guns, searchlights, aircraft, and all naval craft will act in combination. In the event of an attack of class (ii) the requisite aircraft for artillery registration, for bombing, and also any torpedo-carrying seaplanes will be forthcoming under arrangements made with the Royal Air Force. Distant reconnaissance over sea against all forms of attack will be conducted by aircraft, submarines, destroyers and armed vessels, these forming the first line of protection in modern coast defence.

28. *The armament of coast defences.*

Finance alone would prohibit any change in existing types of fixed armament. But no real call for it exists, though naval policy might recommend the transfer of some lighter fixed armament from one port to another.

If the protection of a port—or indeed any part of the coast—by heavy armament is regarded as necessary, then mobile guns and howitzers should supplement the fixed defences. This would enable the artillery armament to be treated as follows :—

Fixed	(Light) (Medium) 12-pr., 4-in., 4·7-in., 6-in.)	For defence against attacks classed under (iii).
Fixed	Heavy (7·5-in., 9·2-in., and heavier)	For defence against attack (ii).
Railway	Medium or heavy (8-in. or upwards)	For defence against attacks (ii) and (i).
Mobile	Medium or heavy and even light (all calibres)	do. Light guns possibly against attack (iii).

This distinction appears practical, since a great quantity of extant heavy mobile and railway material, together with its personnel, would thus be advantageously employed at an outbreak of war and until such time as the course of the campaign should determine the possible use of our entire heavy artillery in the field.

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Anti-aircraft guns[1] will still be required in the future to prevent low-flying aeroplanes or other aircraft from reconnoitring or attacking fixed defences. They will be subject to the central air defence control, but capable of independent action. It may be possible to adapt such guns for horizontal fire.

29. *The construction of fixed works of defence.*

The low-profile, barbette, battery proved its value, whereas the older masonry work failed to withstand heavy ordnance. Some modifications might, accordingly, be made in certain of our works approximating to the latter type. The arc of fire of all batteries must be made as wide as possible, allowing for blast, and obstacles masking gun-fire removed; an example of interference occurred at Hartlepool. Command posts and range finders should, where possible, be armoured and sunk in the ground, the latter protected against vibration and duplicated. Reliable order transmitters are needed. Guns must be protected against splinters from the rear or aerial bomb fragments.

Camouflage against sea and air observation is urgent.[2]

30. *The scientific equipment of coast defence.*

Since radio-telegraphy must play an extensive part in coast defence, its use must be co-ordinated to avoid interference between the services.

Aerial torpedoes, controlled by Hertzian waves, may prove an accomplished fact before long. Such an invention would deeply affect coastal warfare.

The employment of the smoke screen requires careful thought, since it is very subject to weather. Could the Hartlepools have been saved by smoke? The Germans might still have found their target from the flanks of such a screen unless this had been of vast extent. The Lowca benzol works, being smaller, were saved by smoke. The use of lachrymatory compounds by the defence should prove the subject of experiment. Lethal, or disabling, gas of recent type also appears to invite research. Gas might prove a decisive factor in dealing with landing attack. The provision of gas shell to batteries designed to resist troops after landing should be considered. In order to resist gas attack, coast defences should be equipped in the same manner as the Navy.

SECTION V.

CONCLUSION.

31. *The situation of coast defence in 1914 and now.*

Before the war our doctrine of coast defence reposed on sound principles. But a childlike respect for mechanical creations of

[1] A.A. guns made good in the defence of London and Paris in 1917-18. But the raiding Gotha, IV., was of low efficiency: hardly a machine had a ceiling (on its inward journey) of over 12,000 ft.; some scarcely exceeded 10,000 feet. Had the new Gotha, V, with its designed ceiling of 18,000 ft. appeared, the gun might have met with less success. As it was, the consumption of A.A. ammunition was such that it threatened to run out, whilst the wear of the guns necessitated the charges being reduced. The Zeppelin of 1917 with its ceiling of over 20,000 feet feared the aeroplane far more than the gun.

[2] German serial photographs have shown how poorly concealed our batteries were, See also the finding of Major-General Lowther's W.O. Committee held during 1918.

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modern times obscured the precept that no enemy should be credited with a lesser intelligence or greater determination than ourselves. So the adventure which, with all our maritime advantages, we dared not undertake, we still credited as possible from our enemy. The incident of Hartlepool and the first puny German air raids were considered as portents. So in a great new temple we did homage to the distorted idols of invasion and coastal attack, and the rustle of the surrounding trees at sunset was often interpreted as the presage of the hurricane, of the tramp of a foreign army on English soil. Now we know better. Had we then possessed a clearer insight into German preparations, those idols would soon have crumbled into dust.

At the present day, again, when it would appear so simple to revivify our doctrine of coast defence, the obstacles thereto are many: firstly, those reasons given in the opening lines of this discussion; then the lack of experience as to the use of recent war material in coastal attack; lastly, the still unknown possibilities of the aerial arm. Besides these, there is sentiment: the tang of the salt water is ever reminiscent of the glories of the past. Finally, there is the great problem whether aerial defence may not ultimately replace, supersede or perhaps assume, the entire function of coastal defence as this is now understood.

To co-ordinate conflicting interests, older traditions, and more recent modes of thought, ingrained during four weary years of war on the coast, it seems that nothing short of a joint Imperial Staff, or, perhaps, a strong Defence Ministry, will suffice. Then the present theme of coast protection, rejected once of all builders, may reappear cut square and trimmed, if indeed it is still required in that form, as a corner stone to the new structure of National Defence.

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ARTILLERY INTELLIGENCE AND COUNTER BATTERY WORK.

BY MAJOR & BT. LT.-COL. C. N. F. BROAD, D.S.O., R.F.A.

(Concluded.)

Counter battery office.

I have dealt with the limbs which strike the blow :—the guns, the planes and balloons, the observation groups and sound ranging sections. We now come to the brain which co-ordinates the work of all the above i.e. the counter battery office.

In open warfare the rapid sequence of events precludes the elaborate counter battery arrangements required in static warfare, nor are they necessary.

Nevertheless the stabilizing effect of modern gun fire is such, that a commander must always be prepared with as efficient a counter battery organisation as circumstances dictate.

I propose to describe the organisation which was necessary in France. Future wars according to circumstances may require more or less complete arrangements.

The work to be efficient must be done under fairly comfortable circumstances as good light, night and day, is necessary for draughtsmen and photographic examiners. The latter's eyes go very soon if good light is not provided.

Four rooms are really required, one for the C.B.S.O., one for his staff, one for the draughtsmen and photographic work and the fourth for clerks. This office is usually located near, or in the same house as the Heavy Artillery Commander, as most of the work is done with his guns. The longer ranges being attained by field artillery, may however alter this, and field guns may be used in the future more than in the past.

It was chiefly for this reason that the C.B.S.O. was made a Corps staff officer in the beginning, although he never lives at Corps headquarters, but he is responsible to and acts under the direct authority of the G.O.C. R.A. Corps.

The personnel required in a Counter battery office are as follows :

The C.B. S.O.—a Lieut.-Colonel who is responsible for policy, plans for operations, siting of counter battery artillery, expenditure of ammunition and general supervision.

The Staff Captain who is responsible for operation orders and counter battery programmes. Orders for neutralising fire.

The Intelligence Officer—location of hostile batteries, examination and filing of photographs, keeping of records, hostile shelling reports, and intelligence generally from our observation posts, prisoners, agents and repatries.

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The Orderly Officer keeps up maps, and guns in action charts.

And in addition a varying number of clerks and draughtsmen, which normally exceeded the authorized War Establishment of one of each.

The Office is divided in two branches :—

(i) Operations.
(ii) Intelligence.

although, as it is a 24 hour organization, (the operations part, especially, often working as much by night as by day) every officer has to and can deal with either branch. The "next morning" is not good enough in counter battery work.

I will deal with the detail of these two branches later, but in the meantime I should like to point out the rather anomolous position of the C.B.S.O.

He is a Corps staff officer and yet continuously issues direct executive orders in the field to units which are part of a subordinate formation.

He has to use the most conveniently situated batteries which, on the defensive especially, may be the most forward batteries of several brigades.

At present these are mostly under the command of the Heavy Artillery Commander, but when the field artillery come more into counter battery work the situation will be further complicated.

Furthermore the C.B.S.O. has to get batteries sited in positions suitable for the tasks he is actually setting them or anticipates that he will set them, and these batteries are not under his command.

In addition practically speaking all his telephonic orders are very urgent and he has to go through exchanges over which he has no executive control.

If the tasks required from the artillery are such that all brigades can be called upon for counter battery work, then a dividing line of responsibility can be drawn between the field and heavy artillery. This, together with the system of brigade zones, makes it easy for the C.B.S.O. to decide which brigades to call upon for neutralisations; and hence obviates friction.

In practice matters generally went smoothly. These anomalies exist throughout the organization of the artillery and in its relations with the Higher Command and Staff, and are apparently unavoidable. In many ways they make for flexibility of control, and since they exist and flourish, are no doubt suitable to our national temperament, and as such, can be accepted.

Since the C.B.S.O's Office is an actual front line fighting organisation, all the maps, charts, etc. have to be prepared in such a way that any information required comes immediately to hand.

The following equipment will always be found in any C.B.S.O's Office. It is supplemented when required by other maps and charts according to the situation.

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Plotting Board. This is a large scale map mounted on zinc showing all observation posts manned by any units from Observation Groups to Corps observers, which are of any use for flash spotting. Degree arcs for each observation post are marked on the map.

Hostile batteries are accurately entered on the board in their exact positions. An arrangement of strings enables the C.B.S.O. to at once send off any bearing sent in from an observation post and gives him an indication of which hostile battery is firing. The observation group usually sends in the actual hostile battery, obtained by its own crossed intersection, so that the board is chiefly used for other observation posts.

The Fighting Map. Scale 1/20,000 shows our own battery positions with their own arcs of fire; each brigade being shown in a different colour for easy reference. The hostile batteries are marked on the map in their exact positions. This, as its name signifies, is the map used for actual operations.

A suspect map is kept up in the Intelligence branch on a scale of 1/10,000. A card index is also kept up in conjunction with this map. Each sub square of the map in the hostile area has a separate card (see appendix II).

All information gleaned from any source, which does not refer to an already located hostile battery is marked on the suspect map and the full details entered on the proper card.

As information accrues and the suspected battery is definitely located, the information appertaining to that battery is crossed through on the card, the hostile battery is numbered and the information entered up on the record sheet. (See App. III.)

Activity Charts are kept up by putting pins into the active batteries on a "hostile battery positions" map which is issued by the Compiling office.

Different coloured rings round the pin can be used to designate number of time active, calibre, destructive shoots, etc. At the end of the week this map gives a general indication of the enemy's activity, and the measures taken against him. A file of these maps, week by week, enables one to follow out the artillery policy of the enemy.

Map for shelling connections. This is an endeavour to connect the spot shelled with the offending battery by means of previous happenings in that locality. The enemy tells off his units to zones, as we do, so that it is possible to connect fire in a zone with a group of batteries. Thus when other information fails, it may be possible to trace hostile shelling to a group of two or three batteries by means of this map. These can then all be neutralised without loss of time or great expenditure of ammunition.

The map (scale 1/20,000) is covered with a sheet of tracing cloth with the map squares marked through. Each square is divided into three columns; date, hostile battery number or co-ordinate, and

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calibre; guns in red ink and howitzers in blue for easy reference thus :—

10/3	T.A.	15	15.0
14/3	T.A.	80	7.7

In these columns is entered up every battery that is known to have fired into that square. All shelling information is of value for this map, and therefore details are useful to the C.B.S.O. even if received hours after the occurrence. Evidence accumulates, and possibly next time that battery opens, a shelling connection will have been established. If required the battery can then be engaged for neutralisation.

An arc of fire book is also sometimes kept up, prepared as below :—

	E.24	E.29	K.5	K.10	K.16	K.22	K.28	K.34	Q.4	Q.10
T.A.10										
,, 11										
,, 12										
,, 13										
,, 14										
T.D.10										
,, 11										
,, 12										

The figures along the top are the map squares through which our front line passes. The figures down the side are numbers of the hostile batteries. Now if T.A. 10 shells a certain place and the line of fire passes over E.29 square E.29 is filled in. Supposing another day the line of fire of T.A. 10 passes over K.22 then the squares in between can be filled in. Different colours are used for each month so that the map is up to date.

Logs have also to be kept up of all shelling reports sent in, in case they may be useful.

A gun in action board is also kept hung up in the office showing the number of guns each battery has in action that day.

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Now by reference to these maps every kind of information required for operations is at once available. The C.B.S.O. may use his plotting board or map for shelling connections to spot the active hostile battery. He can then see the most suitable battery to engage it from the fighting map, and whether it has sufficient guns in action from the guns in action board and act accordingly.

The Intelligence Branch.

All information is of two kinds—either "known" or "unknown" i.e. concerning a located or unlocated hostile battery.

All information as it comes in must be entered up :—

(i) If about an unlocated battery on the suspect map and card index.

(ii) If about a located battery in the record sheet of that battery.

As each battery is located it is given a zone number.

The logs of shelling reports mentioned before are kept in the "I" branch and form the basis upon which the report on the day's shelling is drawn up.

All photographs are examined and filed in this office. They must be filed in such a manner that any photo can be turned up at any time and all the photos of any particular square also.

The hostile battery record sheets are marked up with the numbers of all photos which show that position, so that at any time the photographic life history of that battery can be turned up.

All new work of a suspicious nature from the counter battery point of view is entered up on the suspect map and car index.

The Intelligence Officer often also keeps up a harrassing fire map by marking up tracks used for ammunition supply, etc., new sidings, dumps, etc.

The reason for this is that the C.B.S.O. often takes over the harassing fire, as he usually controls the 60-prs. In many Corps the G.S. "I" made special harassing fire maps which thus relieved the C.B.S.O. of this responsibility.

The Intelligence Officer has of course to be in very close touch with the squadron artillery officer in order to get all he can out of pilots and observers after they have landed.

The C.B.S.O. holds frequent conferences for Intelligence purposes which the Corps Squadron R.A.F., observation group, sound ranging detachment, and balloons all attend; and se that all available information gets to the Intelligence Officer. These conferences are sometimes held every day.

The Operations Branch.

The point to notice here is that this branch is continuously on duty day and night, week in, week out, and has at all times to be ready for immediate action.

It is not like a battalion or battery or even a division, which all go into action for a certain time, followed by a period of rest. The

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C.B.S.O. is like the Captain of a ship. During the whole time a Corps is in action, which may last continuously for months or even years, he is liable to be called on to the bridge at any time of day and night. His measures may be tested at any moment during the whole of that time by the enemy's artillery, and he has therefore to be prepared to fight at any time by day or night. Moreover he is assisted by only very junior officers, so that he must carry most of the work on his own shoulders.

The duty of neutralisation is what usually causes this continuous work. By neutralisation we mean the opening of fire to stop a hostile battery firing. All information on this subject has to be immediately available, both by day and night; and if the desired result is not at once obtained then other likely hostile batteries have to be tried, and so on. A counter battery office is perhaps the best example of close touch between the operations and intelligence branches of the staff, as if this touch is not so close as to be almost one organization, then the machine breaks down at once.

The continuous night work makes it essential that every officer in the office should understand and have a good grasp of both branches, so that he can act efficiently i.e. engage the right hostile battery with the right British battery, at any time, as it is impossible to keep an officer of both branches awake all night, and it is equally unsound to wake up the C.B.S.O. unless matters are getting beyond the grasp of a junior officer. Furthermore there is no time for the officer on duty to refer to anyone else. Action must be taken at once or it is too late to be of any value.

The other chief duty of the operations branch is the arrangement of programmes for the actual destruction of hostile batteries and for counter battery operations on battle days.

The former programmes are got out daily and need a considerable amount of detailed and accurate staff work, which generally has to be done against time. Specimen programme forms are shown in App. IV.

The information on which the programmes is based should be confirmed as late as possible before the orders are issued, in order that shoots may not be undertaken against empty positions, and yet the programmes must reach the Squadron in time for the necessary Squadron arrangements to be made overnight and for the observer to study and prepare the photograph on which he is going to do the shoot. The shoot will often take place immediately after dawn the following morning, so that all arrangements must be completed the night before.

Finally I come to the *Artillery Intelligence Organization.* This service is concerned with the collection and dissemination of all information concerning the hostile artillery—for making deductions from the information obtained and for co-ordinating the Intelligence activities of the counter battery Office, the Survey units and the R.A.F.

The introduction of Artillery survey companies will make the work of the artillery intelligence service much simpler. In France it

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was obviously impossible to define a dividing line between the artillery intelligence office at Army Headquarters and the Field Survey battalion. The best results were naturally obtained when the two were practically combined.

The responsibility of making deductions is perhaps the most important duty of the artillery Intelligence. This duty is of two kinds :

(i) Forecasts of movements of enemy artillery during battle.
(ii) Forecasts of enemy intentions from the attitude of his artillery.

For the first, four qualifications are required :—

(i) Power to visualise the back areas by means of map reading.
(ii) Knowledge to read the signs on a photograph.
(iii) Knowledge of the enemy artillery tactics.
(iv) Technical knowledge in order to decide the advantages and disadvantages of alternative localities as looked at from the point of view of the hostile battery Commander.

Much time is obviously saved if useful forecasts can be made regarding the movements of a retreating artillery, or the localities likely to be occupied by batteries sent up in support of a battle front.

As regards the second, I do not think it is too much to say that during the German offensive in 1918, the first indications of enemy attacks were deduced from the preparations made by his artillery, and conversely that if the Intelligence Service is working efficiently in this respect it is almost impossible to bring off a strategical surprise when the attack is to be supported by mass of artillery. The hostile artillery preparations in 1918 gave away, in almost every case, the German intention to attack.

The evidence obtained was mainly under three headings :—

(i) Photographic i.e. actual photographs of gun positions and especially small ammunition dumps.
(ii) Artillery deployment i.e. the actual noise made by the movement of batteries into action.
(iii) Prisoners and Secret Service i.e. the capture in one case of heavy artillery officers reconnoitring in No Man's Land; and information re movements of trainloads of Artillery obtained through the Secret Service.

The only really disputed point in artillery intelligence organization is the query as to whether the Artillery Intelligence should be controlled by the General Staff or the Artillery.

The closest touch between the General Staff Intelligence and the Artillery Intelligence is essential as the latter is concerned with matters of vital interest to the former. This constitutes an argument in favour of its being part of the General Staff Intelligence.

The majority of Artillery Commanders however hold the opposite view. The reason being that so long as senior artillery officers are required to take command of concentration of guns, such as holds always in counter battery work and usually in big attacks, so long must

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they have their own staff in order to be sure that the orders issued are an exact translation of their intentions: and no operations staff can function without containing within itself an intelligence branch immediately and always accessible, working moreover, as regards detail, according to the particular requirements of that Commander's brain.

No article on artillery intelligence would be complete without some reference to the work of the ordinary artillery officer in the battery observation post. Most C.B.S.O's will, I think, agree that a good Artillery Officer is the most reliable source of information which they can have. When trained, he can discover much counter battery information from his observation post. In an attack he is often able, by pushing forward, to direct fire onto the hostile artillery and so do first class counter battery work. Similarly Brigade Commanders can greatly assist the C.B.S.O. with intelligent appreciations of the counter battery situation.

Enough has I think been said to emphasize the immense amount of machinery which is required in major operations, in order to be sure of overcoming the enemy's artillery at the critical moment. Many instances can be quoted of attacks failing on account of the efficiency of the opposing gun fire. Counter battery work may or may not have been possible in each particular case. Nevertheless the necessity for it is apparent. Counter battery work is not nowadays a technical artillery matter, but one that vitally affects the tactical efficiency of the whole army.

It is essential, then, that peace training shall not neglect counter battery work; this is very apt to be the case when the effect of Artillery fire has to be left to the imagination of the umpires.

Therefore we must see that in peace time the machinery is not all scrapped and the lessons forgotten.

Wireless Intercept.

On each Army front in France two wireless compass stations were erected for the purpose of ascertaining the position in space of enemy machines using wireless. These were of course chiefly his artillery machines setting out to do a destructive shoot. When located, the position of the hostile machines was telephoned to the Army Wing who at once despatched a fighting machine to bring them down. Before the end of the War this was working very satisfactorily and was indirectly very effective counter battery work.

The skilled operators at the compass stations were able to recognize the enemy observers by their methods of signalling, so that they could distinguish one from another even when using different calls. The moves of higher formations could be traced, and indications of hostile artillery reinforcements obtained in this manner.

The Wireless Intercept Stations also endeavoured to establish shelling connections. When they located a hostile aircraft and were able to connect it with a hostile battery, the fact was reported to the

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C.B.S.O., who added it to his other information and a shelling connection was established. Occasionally the station itself could observe the fall of the shell as well as hear the wireless signals and so establish an absolute shelling connection.

The greatest value of the stations however lay in the destruction of enemy observing planes. How much they might have eventually developed in other directions is impossible to say.

The only remaining point in counter battery organisation to be dealt with is that of signals.

Appendix V. shows the communications which were necessary in France for efficient counter battery work under stabilised conditions.

Everything is plain except perhaps what is called the Report Centre. This system was established in order to economise wire and to co-ordinate and accelerate the system of reporting enemy activity.

The Report Centre is usually established at the headquarters of the Observation Group. Its duties are to report enemy activity with the least possible delay to the persons responsible, in each particular case, for taking action, repeating the information afterwards where necessary. The actual exchange should if possible be under the immediate control of an Officer. Otherwise messages are apt to be sent continually to people who are not concerned.

The O.C. Observation group is supplied by the C.B.S.O. with priority lists and instructions to guide him in his actions according to the particular circumstances of each case.

The reports centre is also of great value in obtaining immediate confirmation of approximate information sent in by a single ray from an artillery or infantry observer, or of an N.F. call from the air. This can be repeated to Observation posts and sound ranging detachments, while the hostile battery is still shooting and confirmation obtained.

The signal diagram may appear complicated and elaborate but is not so really, when compared with the mass of material with which it has to deal.

Constant, quick and accurate information is the foundation of effective counter battery work.

The labour, money and material expended on efficient signals is insignificant when compared with the expenses incurred in the use of our own artillery and the possible destructive effect upon the enemy's.

A hostile artillery is only beaten by cumulative effort, and efficiency in every part of the machine is essential.

I do not mean that the Signals were not efficient. They were highly so, but in France it was usually far easier to obtain permission to expand thousands of pounds worth of shell, with all the labour and materials involved, than to erect comparatively cheap communications for the better control of this fire.

Do not let us be niggardly in peace time over any and all forms of communications, either field equipment, War Establishments of personnel, war reserves of equipment, or experiments.

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The Method.

We will now go on to consider the tactical employment of the means which have been described.

At the beginning of the war counter battery work was done almost entirely by guns as opposed to howitzers, and for lack of aeroplanes, the tactics employed were chiefly searching reverse slopes for hidden batteries.

As the war went on our equipment for this task improved but I do not think that any useful purpose is served by following out this development in detail, as the aims of counter battery work were very early defined and underwent no material change.

Counter battery tactics can be divided under three main heads :—

(i) The continual attack of the enemy's artillery at all times and in all places.

(ii) Neutralization, or the temporary attack of hostile batteries causing damage to our troops.

(iii) Battle counter battery work.

In France the first was considered to be the most important counter battery task.

It is a matter of policy to be decided by the Higher Command whether the continual attack of the enemy's artillery is to be prosecuted with all the means at one's disposal, or whether one's energies are to be reserved for battle days.

It was decided very early in the war on the Western front that the former was the correct policy to be adopted against Germany, and this attitude was maintained to the end of the war.

This policy has the disadvantage that the enemy's artillery is driven further back and that consequently the captures of artillery in major operations are not so great as they otherwise might be. This is particularly noticeable if the enemy outranges us. Nevertheless in a long war where endurance of moral, material and manufacture are the main issues at stake, it is, I think, generally agreed that the continual offensive is the right tactical attitude. Although a temporary superiority over the enemy's artillery may be obtained in an initial attack by suitable battle neutralisation, it will, I think, be conceded, that real superiority during the battle, will only be obtained by a continual offensive aimed both at the destruction of the enemy's material and his moral.

This fact is emphasized by the tendency of modern fighting to be protracted beyond the one day of battle, as in 1866 and 1870.

In the Russo-Japanese War battles lasted a month or more : in the late war three to four months.

Therefore, until the tank or some other novelty revolutionalizes war, the same may be expected to hold good in future wars.

This work is carried out by daily programmes of fire observed from aeroplanes. The chief artillery requisites are good drill and fire discipline, methodical staff work and really red hot information. The

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number of rounds to be fired is a matter for calculation, as it depends partly on the strength of the enemy's cover, and partly on the zone of the gun at that range; and varying of course with the size of the shell.

This number is based on the theory of probabilities and obviously varies with the size of the target.

As a general guide it can be stated that it will usually be necessary to fire the following number of rounds *at each pit* to ensure destruction.

6″ How.	100.
8″ How.	80.
9·2″ How.	60.

This fire for effect is rapidly poured out; the observer watching the general effect only, so that he can save time by ranging another battery at another target while fire for effect is going on.

The effects of destructive shoots are much improved by a little cunning in bringing surprise bursts of shrapnel from 60-prs. either before, during, or after the shoot, onto the detachments, so that personnel may be destroyed as well as equipment.

This matter is well worth attention as the destruction of the personnel is as important as that of the equipment.

It is now laid down officially, that all shoots at artillery should commence by an attempt to catch the personnel at the guns and thus inflict severe casualties.

Incidently if the enemy can be "trained" to leave his guns in this manner, the success of battle neutralisation is assured as it will be difficult to induce the detachments to go back while the fire is continued.

The classic example of this is August 8th, 1918, when many batteries were captured with their muzzle covers still on. Nevertheless it is doubtful if such a success could be obtained against an enemy whose moral had not previously been destroyed by the policy of the continuous offensive. Whenever lack of aeroplanes or bad weather conditions prevent observed shoots being carried out, concentrations may be substituted for them. In practice, concentrations are carried out daily when fighting, since there can never be either the time or the aeroplanes available to carry out all the counter battery work required by observed shoots.

In addition concentrations have their own place in counter battery work as they are undoubtedly very destructive against moral.

They may be carried out by a few batteries or by many hundreds of guns according to the importance of the task.

The main points to watch in arranging concentrations are :—

(i) Synchronisation of fire.
(ii) Change of method.
(iii) The advantages of employing converging fire.

With regard to the last point, medium artillery cannot switch quickly from one target to another unless they have exceptionally good platforms. It is therefore advantageous to allot four to six hostile

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batteries to each British battery (according to the number of guns in action) one gun only taking on each hostile battery.

One advantage concentrations have over observed shoots is that survey units find it exceedingly difficult to locate batteries firing the former.

I do not think it is necessary to say much about ordinary neutralization.

The point to impress on troops is that vague reports of shelling are of very little assistance to the C.B.S.O. as many hostile batteries may be able to shell that particular locality.

From what has been said above regarding the intelligence branch of the C.B.S.O's staff, it will be realised that if he is told the calibre of the offending battery or even whether it is a gun or a howitzer together with the general direction, it narrows down the number of possible hostile batteries enormously, and action can be taken against these batteries with a very fair chance of including the offender. In static warfare this class of neutralization is of minor importance. It is 10 to 1 against any real harm being done by the hostile fire and the continuance of it will provide us with useful information concerning the hostile battery's position, its arc of fire, its normal tasks and probable employment in battle. Should it be doing harm, then serious action can be at once taken against every likely battery if the actual offending battery is not clearly defined.

Furthermore you will remember an artillery aeroplane patrol is kept in the air all day long on the watch for active hostile batteries. Every battery seen active, is wirelessed down at once and taken in by all batteries provided with receiving sets and at the office of the C.B.S.O. so that this wireless call, together with even a general report from the people being shelled, will often pin point the offending battery and provide a shelling connection. If required a concentration on it can be carried out at once.

The chief point to watch in fire of this nature is to see that it does not degenerate into indiscriminate fire all over the country whenever the enemy opens fire. It must be remembered that, as a rule, every round spent in neutralizing fire has to be deducted from either observed shoots or organized concentrations; by which methods only can real effect be obtained in normal times.

Counter battery work in battle aims at a temporary superiority over the enemy's artillery, obtained chiefly by surprise. It is really a form of intensive neutralization. The object is to cover each battery with such a fire that the detachments cannot get up to the guns, or if they do, to impede the working of the guns and passing of orders by noise and casualties to the exposed personnel.

The first thing to do is to make an appreciatoin regarding the hostile artillery strength.

The C.B.S.O. has then to draw up a programme which will include all the known hostile batteries, special attention being paid to those which are thought to be the more dangerous.

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This programme is issued to each brigade of artillery detailed for counter battery work and shows the hostile batteries to be engaged, the times during which each battery is to be engaged and the ammunition to be expended. The targets are also placed in order of importance, should some unforeseen circumstance prevent all being engaged.

In addition to this the C.B.S.O. keeps a certain number of batteries in reserve to deal with unknown batteries whose activity will be notified from the air, or to reinforce any artillery which is found to be too weak to carry out its task effectively.

As a general guide it may be stated that two to three guns per hostile battery are required for efficient battle neutralization.

This system may seem to be very centralised, but it is unavoidable. These operations require the closest co-operation between the C.B.S.O's of adjacent Corps, since the infantry may be shelled by hostile guns miles outside the zone allotted to the batteries supporting them and consequently the only artillery in close touch with them. This hostile fire has therefore to be dealt with by other guns under some system of centralised control which is sufficiently well informed about the hostile artillery on the whole front to be able to act intelligently and effectively, i.e. the C.B.S.O.

When making plans for an attack, the counter battery considerations require at least an equal place with the other artillery proposals. Various circumstances will render a proposed operation favourable or otherwise from the counter battery point of view. As stated above the effect of modern gun fire is such that an operation really unfavourable from the counter battery point of view may produce a situation similar to that of August 26th, 1904. In this action the Japanese Guard Division were completely held up for a whole day, mainly by three Russian Q.F. field batteries (24 guns) with whom their own numerically superior artillery was unable to deal. The Japanese never got within 1,000 yards of the Russian trenches and suffered 1,000 casualties. In those days there was no means of spotting the Russian batteries and hence they did what they liked with the infantry.

To-day we hope that the aeroplane would make such a state of affairs impossible. Nevertheless an attack deliberately launched over ground or under circumstances unfavourable to the various means of observation utilised by counter battery work will produce the same result as in 1904.

The final stabilising of the line about Beaumont Hamel in March 1918 can be quoted as an example of this. The Germans advanced in artillery formation from Achiet-le-grand and Achiet-le-petit towards Beaumont Hamel and Beaucourt. The ground consists of undulating ridges with deepish valleys running across the line of the German advance.

One British 18-pr. battery was in action against this advance with observation on the high ground west of Beaumont Hamel. At long range it was unable to stop the German advance. As the enemy approached they deployed and attempted to cross the ridge between Beaucourt and Beaumont Hamel by rushes. Each rush was met and

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withered by the one 18-pr. battery. The enemy repeated the attack again and again without success with the result that they had to wait for darkness before any further advance was possible.

As an example of detail, when making plans for an attack, the question of boundaries between Corps may be quoted.

It makes for simplicity if the tactical and counter battery boundaries coincide.

This is not so simple as it might appear, as it is complicated by the following two factors.

(i) Batteries which normally fire against a given Corps should be included in that Corps counter battery area. These batteries may, however, be outside the tactical boundary.

(ii) It simplified the R.A.F. procedure if the boundaries follow the grid lines on the squared map.

It is, however, possible in most cases to agree upon one boundary provided the necessary co-operation between the branches of the staffs concerned exists. The advantages to lower formations in having only one boundary is obvious.

When attacking it is generally possible to allot certain brigades primarily for counter battery work and they can then be sited, more or less, to suit the ideas of the C.B.S.O.

He may require big flank groups or special enfilade batteries according to the dispositions of the enemy and the shape of the ground. It then becomes the duty of the artillery Staff to settle the conflicting claims of barrage and counter battery work, and to place the batteries so that they are of the greatest value from the big point of view.

When on the defensive the matter becomes more difficult, as guns are usually limited, and it is also necessary for the artillery to be disposed in depth.

The most forward batteries of all brigades have then to be used for counter battery work. Both the C.B.S.O. and the Heavy Artillery commander want these batteries and the ideal siting of each battery may vary considerably in either case.

The plans for the advance of the artillery during and after an attack is another matter in which the C.B.S.O. is vitally interested. His battle programme will visualize this event and must make provision for sufficient batteries for counter battery purposes to be in action at all stages of the attack.

The Heavy Artillery Commander has to make similar plans for the advance of medium and heavy artillery for the support of the attack on the more distant objectives. These plans therefore form a suitable subject for consideration by the artillery staff in order that they may be co-ordinated in a manner most likely to advance the general tactical plan.

During the late war the C.B.S.O. was not officially responsible for the advance of the observation group and sound ranging detachment in the Corps area, as these units were under the command of the O.C. Field Survey battalion.

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Now that the artillery survey companies exist, the C.B.S.O. will presumably be responsible for organising their advance. Incidentally it may be noted that these units still lack the necessary transport which is an essential part of any field unit. The intelligence branch of the artillery staff at Army Headquarters will, in this case, have to co-ordinate the plans of adjacent Corps in order that the positions of these units, when ordered into action, may be suitable from the big point of view.

As explained above, the placing of observation groups and sound ranging detachments is essentially a matter for centralized control, since these units must overlap along the whole front.

This is emphasised by the fact that once in action the labour involved in making small adjustments is too great to be undertaken. Hence, additional units would have to be brought up to cover gaps. These units may not exist.

Counter battery work in France reached a high state of excellence owing to the long periods of static warfare and the semi-mobile character of the most active operations. Very little experience was gained in the class of fighting which might be expected in the opening phases of a war in Europe at the present time with the reduced state of all armies.

Under these conditions counter battery work becomes infinitely more difficult, although it will be realized from the examples quoted in 1904 and 1918, that its importance is just as great as in static warfare.

In open warfare it may be possible to lessen the power of the machine gun by manœuvre. Whether this is so or not, it is certain that it will be exceedingly difficult to avoid the hostile gun fire by manœuvre.

Troop movements on roads will be seen from the air; the actual attack will be overlooked from the observation posts. We must therefore be able to counter the enemy's guns.

It will I think be generally agreed that we have not advanced very much in the solution of this problem since the war.

In approaching this problem, we may primarily consider the following points :—

(i) Static warfare provided the complete answer as regards counter battery work.
The principles employed in static warfare should therefore be followed in open warfare as far as circumstances permit. We shall thus keep a high standard of efficiency before us.

(ii) In normal country, the shelling to be endured by the infantry will vary inversely with the counter battery strength.
If it is such as to stabilize the advance, then the remedy lies in increasing your counter battery strength.
The timely production of the various units, etc., which go to make this strength will however require considerable pre-

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vious forethought, and is a fit subject for a very careful appreciation of the situation before the advance begins.

(iii) Counter battery strength under these conditions may be said to lie in :—

(a) Observed control of fire from the air. This is an entirely different thing to observation by an R.A.F. Observer.
The advances made in wireless telephony tend to make the aeroplane the perfect observation post for the counter battery commander of an advance guard.
The fire will then be directed by a trained artillery tactician.

(b) Suitable artillery for the task. The most suitable artillery is generally the heaviest on account of its range and shell power. This points then to the inclusion of, at any rate, medium artillery in an advance guard of any size. The British counter battery success in the late war may I think be largely attributed to the skilful use made of the 12″ howitzer. The principle is therefore clear. Use a more powerful weapon than the enemy and destroy him. The advances being made in motor traction will very shortly overcome the objections which are raised on account of the weights involved when dealing with heavy artillery.

(c) Sufficient ammunition. This is not required on the scale laid down for destructive shoots, but all the same remains the most serious artillery problem in open warfare.
In March 1918 abundant ammunition was available in the various dumps echeloned back behind the Armies as far as Amiens. It was found that batteries could use this ammunition on a very large scale in spite of the open nature of the fighting. This scale was in the region of 200 rounds per gun per day for 18-prs. and 100 for 6″ howitzers.
The weights involved in advancing ammunition will always provide a very drastic limitation to the size of the guns: the weights of the latter being negligible in comparison with the tonnage they can consume.
Suitably organised motor transport would again appear to be the solution of this point.

(d) Suitable preparations for the rapid enlargement of counter battery work.
This visualizes a measure of control by the C.B.S.O.; the use of an observation group and later a sound ranging detachment. In 1918 good results were obtained from observation groups in semi-mobile war-

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fare by working the posts in two waves leap-frogging over each other; one wave being always in action. Inter-communication was maintained by C-W wireless and all information was sent out by a sending set in exactly the same manner as from the air.

As regards sound ranging detachments, it is rarely advisable to order them into action unless a halt of 48 hours is expected. As an example of what can be done, one sound ranging detachment on a fighting corps front between Nov. 3rd and Nov. 6th, 1918, located 17 hostile batteries with a mean error of 110 yards, tested by resection of the hostile battery positions after the Armistice. An essential item in the above is, as noted before, the training and equipping of the above Units as field troops.

Open warfare, as far as war experience goes, demands immediate decentralisation of control.

The amount of control that is possible is really automatic as it depends on the pace of its operations.

This again depends on the strength of the enemy fire power.

The effect of this fire power, as regards the hostile artillery, depends on the counter battery strength of the attack.

As shown above counter battery strength finally includes a measure of control by the C.B.S.O. if the previous means have not attained the desired end.

Whenever the pace of operations forces decentralization of control, the C.B.S.O. must be represented in each division by an officer trained in counter battery work.

The C.B.S.O. will be employed in seeing that the information in possession of the R.A.F. squadron actually gets to the Divisions, and is controlling the movements of the R.A. Survey company.

The division of the country into zones when moving rapidly is a matter of extreme difficulty in practice, particularly in those cases where a squared map is not available.

Under these conditions map shooting cannot be so effective as in static warfare, and it is improbable that the ammunition will be available to indulge in it to any large extent.

The N.F. call thus becomes more of value as information rather than as a target for actual neutralisation. Under present conditions the best results will probably be obtained by an A.N.F. call. The more one considers the problem, the more it becomes impressed upon one that, under these conditions, the observer must be an officer who is not only in a position to be a sound tactical judge in artillery matters but also capable of actually commanding the fire unit. In other words he must be the battery commander.

Two or three such batteries of suitable shell power and range with their battery commanders in the air should do much towards solving the counter battery problems of open warfare. From whatever aspect

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one regards modern warfare, it is apparent that the air will play an important part at all times. One of the main essentials in efficient co-operation with the air is the provision of squared maps of a suitable scale.

It is manifestly impossible to prepare these maps for the whole world, although their importance would make this desirable.

What is possible, however, is that our mobilisation machinery should include arrangements for the rapid production of the required maps immediately there is a serious threat of war.

In conclusion, the writer would again urge that the counter battery side of operations should not be neglected in our peace training.

In war the most rapid operations move comparatively slowly. This is due to the slowing effect of fire of all natures. In manœuvres this fire is absent, with the result that the slowest operations move so quickly that there is rarely time for the artillery to take any serious part in them.

This is probably unavoidable as it is impossible to really reproduce the war atmosphere however many umpires there may be.

It is however essential that the officers of the Army should not remain ignorant of the effects of artillery fire in war, the conditions under which this fire is most effective, and the various limitations to which it is subjected.

All artillery operations entail an enormous amount of detail when it comes to actually working them out in practice. This detail again takes more time in staff rides, etc. than the remainder of the tactical work; and consequently has to be largely omitted so that the two or three days available for the tour may cover a week or two of actual operations.

The only solution would appear to be that the artillery side of any staff tour should be really worked out in a separate exercise.

Otherwise we, as a regiment, may fall into the habit of taking as done, things which we never have really done and hence become unduly optimistic both in time and execution; and our brethren in the other arms will relapse into the unsatisfactory if somewhat complimentary generalisation of "the artillery will co-operate."

If the artillery could co-operate equally well under all conditions, this would not matter. We all know generally that this is not so. We all want the best value from the artillery and are prepared to adjust our operations to obtain this result. Let us see then that our system of training enables all officers to learn sufficient detail about artillery for them to become efficient judges of the tactical employment of the artillery on the battlefield.

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APPENDIX II

SUSPECTED BATTERIES

SQUARE L.13.

DATE	REPORTED BY	LOCATION	REMARKS
~~3.5.18~~	~~V Sec~~	~~L 13d 2.3~~	~~1-10 cm gun "Q" Bty:~~
5.5.18	do:	L13a 2.8	1-15 cm howr
~~6.5.18~~	~~5 Group~~	~~L13d 3.3~~	~~1-10 cm gun "P"~~
/	~~7 Group~~	~~L13d 10.25~~	~~1-? gun "B"~~
/	~~H2 R.A.F~~	~~L13d 21.30~~	/ ~~N.F. call~~
8.5.18	D.D. Sec	L13b 5.9.	2 ? guns A.P.
9.5.18	V Sec	L13a 9.9	1-10.5 cm Howr R

NOTE 1. The 10 cm gun battery in L 13 d is definitely located on 6.5.18 and the entries referring to it are therefore erased on the card index.
The battery is given a zone number and a Record sheet (app III) started for it.

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App. III.

SPECIMEN OF HOSTILE BATTERY RECORD SHEET.

Number L.C.20.

Position	L. 20. a. 3.4 (R)	Calibre 10 c.m. gun.
Other emplacements	L. 20. a. 42.40 30.40 (R) 25.39	R.A.F. visibility A.

Photo & date.	Target or Arc.	Reported by	Date.	Co-ordinate	Calibre	Accuracy	Remarks.
42 AB. 60 (8.4.18)	K. 7	5 Group	5.3.18	L.20 a. 2.3	1-10 cm. gun	P	
2100 (17.6.18)	K. 7	U Sec.	17.5.18	,, 3.4	,,	R	
42 H.A.7. (18.5.18)	? K. 6	4 KBS	18.7.18	,, 4.4	—	—	
50 (20.7.18)	K. 4	U Sec.	18.7.18	,, 3.3	1-10 cm. gun	S	

Date.	Time	Engaged by		Rds.	Nature of observation	Remarks.
		Battery	Calibre			
6.3.18	1600	360 S.B.	8″ How.	200	42. R.A.F.	Ranged in 30 rds. with 1 O.K. 2Y 3Z. O.K. on No. 2 pit caused fire and several small explosions. During f.f.e. 2 O.K.—3Y. 2Z. Pits believed damaged.
19.7.18	1500	49 S.B.	6″ How.	300	do.	Ranged in 40 rds. with 6Y. 7Z. During f.f.e. No. 3 pit hit twice and destroyed Nos. 1 & 2 pits damaged.

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Appendix IV.

Corps Counter Battery programme of shoots for ——(date) in co-operation with —— Sqn. R.A.F.

Numerical order of importance.	Target Zone No.	Co-ordinates.	Photo No.	Battery to be used.	Wireless Call.	Calibre.	No. of guns in action.	Nos. of rds. to be fired.	Time of flight.	Time to commence.	Remarks.
		denote Ranging pit.									

Lieut.-Col.,
C.B.S.O —— Corps.

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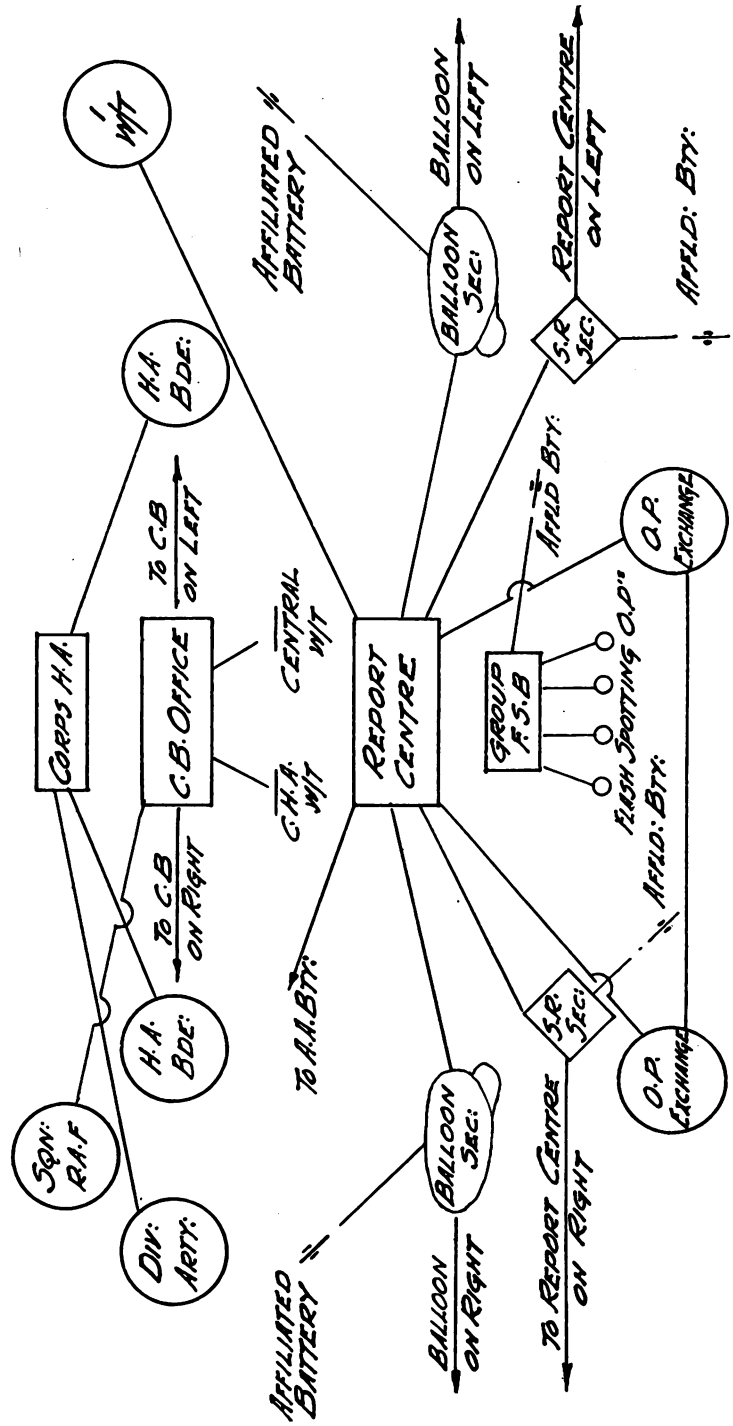
APPENDIX I.

DIAGRAM SHOWING COUNTER BATTERY COMMUNICATIONS.



THE ORGANISATION AND EMPLOYMENT OF PACK ARTILLERY.

BY CAPTAIN H. S. THUILLIER, R.G.A.

THE words organization and employment are, in the case of a military unit, very closely interdependent. A unit is organized in such a way that it can best be employed to carry out certain duties. These duties are of course outlined by the General Staff. Let us examine the present organization of a Pack Artillery battery in order to arrive at an idea as to its duties. At present a pack battery is nearly always organized so that the whole of its equipment, stores, etc. can be carried normally on pack animals.

Without going into details what does this mean in that important consideration Ration Strength?

Taking the figures for Firing Battery and 1st Line only.

Per 2·75″ Gun 27 mules.
Per 3·7″ How. 33 mules.

In addition 20 horses per battery for officers and staff.

That is per battery of 4 2·7″ Guns 128 animals and 190 men.
per battery of 4 3·7″ Hows. 152 animals and 220 men.

The outstanding fact of such an organization is that the ration strength is very large for such a small return in shell power.

Some idea can now be formed as to the normal duties of a battery organized on these lines. These are to assist the movements of the infantry when they are operating in country which is impassable to wheeled artillery.

The grave disadvantages of pack transport must be accepted if this duty is to be efficiently carried out.

These include, as well as large ration strength, slow movement and excessive road space. The result has been in the past to confine the use of such batteries to countries impassable to wheels in any form.

Much experience was gained during the war in the artillery requirements of infantry operating in many different types of country.

They fought at one time or another in practically every type of country which they are likely to operate over in any small war of the immediate future.

Consider first the main duty of the artillery as an arm, it is to assist the movements of the infantry at all times in the most efficient way.

Now consider the main types of country in which operations may take place in the future and the efficiency of the close support artillery as at present organized and employed.

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(A) *Country impassable to wheels over the whole area* such as N.W.F.P. India, African bush and certain deserts. Pack transport is required to give efficient close support to the infantry. Can the present organization be improved. The present design of pack saddle requires a special saddle for each piece of the gun or howitzer. In order to replace casualties quickly due to wounds or exhaustion among the gun mules, for nearly every gun mule a relief or duplicate mule has to be provided. If a satisfactory universal load saddle could be designed then a saving of mules and hence men could be made. One design of saddle throughout the battery to carry any load. Certain Foreign Pack Artillery have achieved it. With this improvement then 12 animals and 12 men could be saved for a 2·75″ gun battery and 16 animals and 16 men for a 3·7″ How. battery and other advantages would also result.

(B) *Country roughly divided into areas certain of which are passable to wheels and certain of which are not.* Such as the Balkans, Anatolia, Mesopotamia, parts of Russia and China. A force operating in such a country has frequently to traverse parts of both areas, as far as its fighting troops are concerned, during alternate days. The close support artillery as at present organised is not adaptable to such conditions. Conditions under which the non savage small wars of the immediate future may be fought.

Pack Artillery is inefficient in the areas passable to wheels by reason of its slow maximum rate of movement compared with wheeled artillery. It cannot exploit an advantage or support a withdrawal with such success as wheeled artillery can. A word regarding maximum rate of movement. It is unsound to argue that because the Force as a whole can only move at say three miles an hour, therefore the guns need not be able to go faster. In an engagement every minute the guns are on the move they are lost to the infantry. Any arrangement which efficiently increases the rate of movement of the guns is an advantage. Wheeled artillery is also at a disadvantage in the areas only freely passable to pack animals. Its activities must be confined to the vicinity of the road, which must be prepared for its passage. This incurs a delay or the alternative of proceeding without the wheeled artillery. Thus it can be seen that wheeled artillery has, under these conditions, great difficulty in giving really close support to the infantry. Wheeled artillery is a vital necessity with a Force fighting an organized enemy, for only from wheeled artillery can weight of metal be obtained.

If pack artillery could be economically used to give close support to infantry operating under these conditions, it could help the wheeled artillery to complete a duty which it sometimes finds difficult to carry out.

Pack batteries operating with a force under these conditions could be issued with a pack limber per gun, consisting of an axle, two wheels and a pole and a light framework on the axle to carry some pack transport ammunition boxes. The pack limber could be carried on one of the two remaining relief mules when the gun was in pack. The

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driver must be mounted in order to get the increased speed of movement so necessary whenever wheels can be used.

In order to mount the drivers and Nos. 1, 2, and 3, four or five pack and riding saddles could be issued per gun to replace a similar number of universal load saddles. These saddles could carry side loads or be used for riding. The ammunition carried on these saddles when in pack could be transferred when the gun was in draught partly to the limber framework and partly to the unloaded gun mules so freeing the saddles for riding. With gun moving rapidly in draught Nos. 1, 2, and 3, could fight it till the remaining three numbers arrived with the 1st Line ammunition in pack.

A pack battery so organized could usefully supplement the close support artillery of a force operating in country which offered considerable difficulties to the free passage of wheeled artillery.

Consider the third general type of country met with.

(C) *Country entirely passable to wheeled artillery over the whole area.* Any well developed non-mountainous country comes under this head such as Western Europe. The only obstacles to wheels met with being temporary ones. In the past the close support artillery used in such countries has been practically entirely wheeled. Latest examples of this type show a tendency to longer range and increased weight of gun. This is sure to mean increased difficulty in man handling and giving really close support, the essence of which is being on the spot all the time to deal with unexpected obstacles.

Here again pack artillery, if suitably organized, could help the close support wheeled artillery in their work. If the pack weapon especially the ammunition could be adapted to deal effectively with Tanks then its usefulness would be greatly increased. In considering the organization of pack batteries operating in this type of country the following points should be borne in mind.

(a) Pack Artillery by making use of its pack equipment can often traverse ground unobserved, in daylight and in close proximity to the enemy where wheeled artillery would be prevented. (b) The utmost economy must be observed in men, animals and equipment at the same time achieving the end in view.

The normal means of transport then under these conditions must be wheels throughout on the lines of a wheeled battery. In addition there should be facilities for carrying the gun or howitzer and a little ammunition in pack, if possible without rendering the wagons immobile. This could be done if the off animals of the teams were provided with universal load saddles and the near with pack and riding saddles. A re-arrangement of the teams would then enable the gun to proceed in pack and the wagons could still be moved. The ammunition could be carried in the open limbered wagons in the boxes pack transport.

With this organization then the utmost economy would be attained in men and animals. Owing to the arrangement for moving the gun and a little ammunition in pack if required the passage of local bad

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obstacles would be ensured. Also full advantage could be taken of cover in moving the gun over exposed country.

Ammunition supply could be carried out by wagon or pack to the guns in action owing to the provision of pack and riding saddles.

The figures would work out to roughly for

4	2·75″ Guns	78 animals	110 men.
4	3·7″ Hows.	94 animals	120 men.

Arranged briefly as follows.

Firing Battery.	Gun.	How.	
Gun Team	4	6	
One Ammunition Wagon	2	2	
1st Line.			
Two Ammunition Wagons	4	6	(3 wagons).
Tech. stores, water, etc.			
One Wagon	2	2	
Barebacks	1	1	
Sub-section Totals ...	13 mules.	17 mules.	

Six extra horses for Nos. 1 and 2 coverers bring Bty. Staff total to 26.

The number of mules in the gun teams would vary according to circumstances. Four and six are provided thereby enabling the gun to get into pack for short distances by borrowing the off wagon mules.

These figures even allowing for the weaker shell power compare favourably with a wheeled battery.

Summing up then it appears that Pack Artillery in the past has only been used extensively in country not passable to wheeled artillery. The experiences of the war, read in the light of probable future requirements, show the difficulty wheeled artillery have in giving constant and close support to the infantry. The possession of a powerful weapon such as the 3·7″ howitzer should be fully exploited so as to minimise these difficulties.

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HOW THE PRESENT MILITARY SITUATION IN GERMANY AFFECTS FRANCE.

From the French point of view and as extracted from articles appearing in the *Revue Militaire Francaise*, March—April, 1922, by

COMDT. DUMONT.*

TRANSLATED BY

BRIG.-GENL. W. EVANS, C.M.G., D.S.O.

Two years have passed since the ratification of the Treaty of Versailles.

During these two years Germany has handed over to the commissions of control :—

33,000 guns.
86,700 machine guns.
about 4,500,000 small arms.
13,000 aeroplanes.
30,000 motors.

The army has been reduced to 100,000 men.

Judging by these material results one is tempted to believe in the loyalty of Germany in disarming herself, the first step in the general progressive disarmament aimed at by the allied and associated powers.

However there is no doubt that Germany up to the present time, far from loyally accepting the provisions of the Treaty only does what she is forced to.

In his book on *Politics and the Conduct of War*, Ludendorff says :

"Fighting is a universal law, as well for the individual as for a "nation. It is a natural state founded on the divine ordering of the "world. Our enemies, and our democrats laugh at us when they talk "about universal peace, disarmament, the pacification of peoples We "must renounce such ideas for ever unless we contravene the divine "law."

"War will always be the final, and the most decisive factor in "politics . . . ."

M. Walter Rathenau writes : "He who classifies fighting which "for 10,000 years has occurred between peoples as due to lack of "education, is capable of believing that an arbitration tribunal can "produce universal peace . . . ."

Many people in Germany are of the same opinion, as expressed in the preceding paragraphs, firstly by the former Quarter-Master General of the Imperial Armies, and secondly by the greatest pacifist of the German industrial magnates.

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* Comdt. Dumont. "La situation militaire actuelle de l'Allemange." *Revue Militaire Française*, Nos. 9 and 10.

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Since the discussion of the army estimates in 1921, all political parties except the independent socialists and the communists, agree in wanting the strongest army possible.

The official pronouncement of the Government in January, 1921, states:

> The peace dictated to us at Versailles imposes on us a military system which we cannot submit to except as a *temporary measure*. The object we should have in view is a short service militia army.

The only reason Germany submits to the provisions of the Treaty is that submission is the only means of getting rid of the commissions of control. Once these have gone, they can adopt their plan of a militia or . . . . an Imperial Army?

I. The army of to-day or the "Reichsheer."

The German Republic concentrates at Berlin the working of the various departments of the army in one single ministerial department the *Reichswehrministerium*, which administers both the army and marine.

(The Prussian, Bavarian, Wurtemburg and Saxon war ministries that existed previous to the revolution of 1918 are suppressed).

The command of the armed forces is delegated by the President of the State to the National Defence Minister who carries out his work through—

(*a*). The *Heeresleitung*, which is under a General and deals with organisation, instruction, and operations.

(*b*). The *Heeresverwaltung*, under an under secretary of state deals with clothing, accommodation, equipment, the medical and veterinary services, and is purely administrative.

So that all the characteristics of a "great general staff" are found in the Heeresleitung.

General von Seekt is its head.

He was C.S.O. to Mackensen and prepared in 1915 the break through of Tarnow in Galicia, conducted the Serbian campaign that autumn, afterwards chief of staff of a group of armies on the western front. He was thought of as Imperial Chancellor.

In 1918 he went to Constantinople as C.G.S. to the Turks, but too late to play an important part.

On his return to Germany in October 1918, soldiers would have liked to have seen him succeed Ludendorff; but the government of Prince Max of Baden, selected Gen. Groener (the present minister of transport).

Immediately after the Armistice, von Seekt was appointed to command the troops in E. Prussia, where he remained until appointed to the ministry of the Reichswehr.

If the Reichsheer is only a temporary army, it must be:—

"Only a sort of school from which a militia army can be formed, and it must be organised so that passage from one to the other is prepared for."

This demands:—

(1) Numerous cadres of picked men, capable of instructing the units of the new army which no doubt will exceed in numbers the present Reichsheer.

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(2) Material in sufficient quantity.
(3) A properly co-ordinated organisation.

As the Treaty is clear on the subject of organisation, armament, &c., the German command takes every opportunity of arguing about it, and demands less strictness in seeing it carried out, pleading as excuses the menaces of Bolshevism and Revolution.

The formation immediately after the Revolution of 1918 of a volunteer army of 400,000 men and the successive stages in the reduction of the effectives, permitted careful selection of cadres. Not only have they kept the best, but beyond this officers belonging to branches forbidden by the treaty have been retained—Aviators, heavy artillery and anti-aircraft officers.

These have been kept on, so they claim, to prevent injustice to officers of those branches in the disbandment of the old army, in reality to make sure of having efficient heavy artillery, and aviation when the day comes for these branches to be "re-born."

A surplus of senior officers is also retained. (e.g. 11 senior officers in the 21st infantry regiment).

Général Nollet of the French Commission of Control considers they form "complementary cadres" and urges their reduction.

Supernumerary officers although wearing officers uniform and paid as such, figure as N.C.O's.

This fact has recently been found out, and the Commission of Control is taking action.

17,627 N.C.O.'s are budgeted for by the Reichswehrministerium.

To avoid depriving N.C.O's of the old army of their pensions the 1920 budget allowed of supernumeraries being kept on bringing the total up to 41,877.

The German high command keeps in the Reichsheer the greatest possible number of men who served in the imperial army. Care is taken that rank and seniority bring good social position to officers, and that the army as a career shall lose none of its status, or traditions.

It is hoped in this way to attract the right sort of young fellow to present himself for examination, and to raise the educational standard of the corps of officers.

In theory the profession of arms is supposed to be open to all, but in practice the recruiting of officers is by strict selection.

Germany appears to be "camouflaging" the budget, and trying to keep up arsenals and factories capable of producing war material.

The interallied Commission of Control has come across many secret stores of arms, e.g.

In August, 1921, at Mauser's a large amount of material for the manufacture of rifles was discovered.

In October at Potsdam, three 105 howitzers.

Postnicken (E. Prussia) eight 77 guns hidden in a foresters barn.

In November a lot of drums of machine gun ammunition found at Potsdam.

In December at Heidenau in one factory 343, 105 howitzers with breech blocks, ready for mounting on carriages were found with more 105 material in course of construction.

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Certain arsenals were to be shut down, but the German government succeeded in getting some kept on, to prevent too many men being thrown out of work.

Erfurth and Spandau thereupon started to make "sporting" rifles —same bore and ammunition as the service rifle! In September last when the Commission of Control stopped this; there was an outcry on the part of the working mens' organisations about interfering with the economic development of the state.

The semi-military organisations that arose in Germany since the Treaty were :—

(a) The *Sicherheits Polizei*—officers and men of the old army—good troops.

(b) The *Technische Nothilfe*—unarmed specialists to assure public services in case of strikes.

(c) The *Einwohnerwehren*—Volunteer reserves—armed but only available locally.

(d) The *Zeitfreiwilligen*—Volunteers ready to join the army when and for as long as required.

These were supposed to be police forces.

Later (d) became absorbed in (c) which became transformed into a number of societies federated under the name of the Orgesch.

All these are partially disarmed and broken up, but there now exist the :—

National Verband Deutsche Offiziere.
Deutscher Offizier Bund.
Verband National Gesinnter Soldaten.
Kyffäuserbund. (The Kyffäuser is a mountain in the caverns of which legend has it that Frederick Barbarossa's spirit awaits the day when a united Germany shall be all powerful).

The objects of these associations are :—

1. To devolop the national spirit.
2. Create regimental associations.
3. To educate in the military sense the youth of the nation.

It is only to be supposed that (as at Berlin), all the universities and colleges are full of ex-officers, imbued with the military spirit. (In Berlin, out of 14,500 students, 280 are ex-regular, and 3,500 reserve officers).

Major Dumont sums up his two articles on the military situation in Germany by saying that far from the Government and War Office maintaining an army "*solely to maintain order in Germany and to police the frontiers*" they regard it as an army of transition, government wanting to turn it into a short service militia army, the military high command to restore the military power of Germany.

He again insists that Germany possesses a "camouflaged" general staff, is developing the police force, and that although the state factories are demilitarized they are ready to take on anything.

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AN ANGLE OF SIGHT READY-RECKO NER.

BY MAJOR M. D. BELL, R.A.

IN Volumn XLVI No. 6, the Journal published a Ready Reckoner for battery angle and range, compiled mainly for the map-less and hill-bound F.O.O. in Pack Artillery. To complete the ever-present trio which have to be reckoned with, I now add a ready-reckoner for battery angles of sight. Doubtless, many officers carry rough notes which are on much the same principle as this table, but the latter is as complete as will ever be found necessary, and from it gun angles of sight can be found very much more quickly than by the BOOT formula, and without any harassing conversion of large angles of sight into minutes, which again have to be multiplied, and then divided by ranges to produce the result. It is claimed that, with this table, pasted on to the back of the TOB ready-reckoner, an F.O.O. carries in his pocket the wherewithal to take on any target, and is independent of plotters and hurried calculations against time.

The use of the table is simplicity itself, and examples of this are appended.

1. From the O.P. to Battery—Range is 1250, and 3.S. – 3° 10′ to Target—Range is 1500, and A.S. + 50′ while BT works out at 2500.

Turning to the ready-reckoner, we find that this makes the O.P. 210 feet above the battery, and 65 feet below the target. Hence target is 275 feet above battery which the table gives, at 2500, as equivalent to an angle of sight of 2° 5′ elevation.

2. The O.P. is on a cliff with the battery close by in the river bed, but 150 feet below it.

   From the O.P. the angle of sight to target, whose range is 3750, is + 1° 35′.

Now the battery angle of sight will be greater than that from the O.P. by the amount which 150 subtends at 3750, which the table gives as 45 minutes.

Hence battery angle of sight is 2° 20′ elevation. Interpolation is easy. For a range of 1100, halve the heights shown under 2250, or take the mean between heights shown under 1000 and under 1250.

For a range of 400, take a fifth of those shown under 2000, and so on.

There is no necessity for minute calculation to the nearest foot, because the reconversion back again into final angles of sight counteracts any small errors.

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R

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SURVEY FOR BATTERIES.

BY MAJOR JOHN PENROSE, M.C., R.F.A.

"En bataille comme à un siege, l'art consiste à faire converger un grand nombre de feux sur un même point : la mêlée une fois établie, celui qui a l'adresse de faire arriver subitement et à l'insu de l'ennemi, sur un de ses points, une masse inopinée d'artillerie est sûr de l'emporter".—*Napoleon's maxims.*

SURVEY has been defined as "the process of fixing the relative positions of points on the earth's surface". Such a process must be of necessity of interest to the Artillery, who are constantly concerned with the relative positions of two particular points, namely their guns and their targets.

The study, the use, and the making of maps (the latter under the name of "sketching") have always been considered soldierly accomplishments. The development of what are called "survey methods" is only an extension of the same idea to keep pace with modern conditions.

During the late war all survey work was carried out by the Royal Engineers, the personnel of this Corps being the only source from which trained surveyors were obtainable.

Field Survey Companies R.E., and later Field Survey Battalions R.E. were charged with :—

(i) Completion of the triangulation of the theatre of war.
(ii) Drawing and re-production of maps.
(iii) Fixing our own batteries.
(iv) Provision of bearing pickets.
(v) Counter-battery intelligence, comprising flash spotting sound ranging, and the plotting of air photos.
(vi) In some cases laying out lines of fire for our guns.

It generally happens that, when any novel and so called "technical" addition is made to the duties of the Army, the job is handed over in the first instance to the Royal Engineers : and when this Corps has done the spade work and made something practical of it, it is taken out of their hands. Flying and Signals are cases in point, and Artillery Survey has been no exception.

For though the Royal Engineers still retain the responsibility for duties (i) and (ii) above, the remainder have been handed over to the Royal Artillery.

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DIVISION OF DUTIES.

The normal division of survey duties in the artillery is :—

Artillery Survey Companies :—

(a) Taking over the triangulation from the R.E. surveyors, and establishing further trig points where required.
(b) Establishment of bearing pickets.
(c) Issue of trig lists and other survey data to batteries.
(d) Flash spotting and sound ranging.
(e) Screen calibration of guns.

Batteries of Artillery :—

(a) Fixing the positions of their guns.
(b) Laying out their lines of fire.

It is with the last two duties only, viz : those that are carried out by batteries, that these notes are concerned.

GUIDING PRINCIPLES.

The object in view is to be able to reproduce the conditions mentioned in F.S.R. Vol. II. Section 12 (1), under which "artillery is able to develop an overwhelming bombardment without previous warning and to engage targets by day and night without observation and yet with accuracy".

Now the art of surveying consists largely in appreciating the errors inherent in different methods of working and in selecting the most suitable method to give the accuracy required for any particular operation.

It is clearly wrong to adopt a method that does not give the necessary accuracy : it is equally wrong to adopt a method that is unnecessarily accurate and consequently unnecessarily slow and laborious.

The limiting factor which governs work in battery surveys is the accuracy of the shooting of the guns. And all guns being considerably more accurate for line than for range, the chief consideration is to be able to lay out lines of fire within the limit of accuracy of the guns for line.

It may be taken as good enough if the guns are laid within ten yards of their target. This is considerably outside the 50% breadth zone for most natures, but is permissible on taking into account the difference between service conditions and experimental conditions under which range table zones are determined, and the fact that narrow targets where great accuracy for line is required will generally be engaged with the fire of several guns whose combined zone will be broader than that of a single gun.

For light guns (especially 18-pdrs.) which are very accurate for line, this limit should be reduced if possible : while for larger natures, which are not generally so accurate for line and the effective breadth of whose shell burst is greater, it may be extended up to, say, 15 yards. But as a limit to cover a system of general application, 10 yards will suffice.

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The ability to work to this limit is essential to accurate predicted shooting; but even when fire is to be observed from the ground or from the air the fact that the lines *are known to be correct from the first round* will greatly reduce the amount of time and ammunition expended in ranging.

THE BATTERY COMMANDER'S PROBLEMS.

The problems that confront the B.C. who wishes to lay out a predicted line on to a given target are two in number :—

Firstly, to know on what line to lay his guns.

Secondly, to lay his guns on this line.

The most obvious methods of solving these problems are :—

(i) To spot down the positions of the battery (pivot gun) and of the target on a map, and to measure off the grid bearing of gun—target line with a protractor.

(ii) Having thus found the direction of the target, to put the guns on to it with either a prismatic compass or the compass on the director.

Unfortunately neither of these methods can be trusted to give the line within the required limits of accuracy : or, in other words, if these methods are accepted as the most accurate that are going to be employed, the guns will not be used up to the limit of accuracy that they can give.

The use of methods (i) and (ii) above is limited by the following considerations :—

(i) Measuring the line off the map :—

(a) This pre-supposes that an accurate large scale map is available. But the portions of the earth's surface that are mapped on a scale of 1 :25,000 or larger, are very limited indeed. Roughly speaking large scale maps exist of the following areas only :—

Great Britain and Ireland.
Belgium and Holland.
A strip along the Northern and Eastern frontiers of France which was surveyed on a large scale during the war 1914-18.
Germany.
Parts of Austria and Italy.

If we fight in any other part of the world we cannot hope to begin the campaign with a large scale map : and it took two to three years to produce large scale maps of the Western Front during the late war.

(b) The paper on which a map is printed is liable to considerable distortion, which distortion may throw the accuracy of a bearing measured directly from the map well outside the limit.

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(c) Even if a large scale map which is not distorted is available it is necessary to use a protractor of such a radius that an angle of 5′ can be read from it with certainty to give the bearing sufficiently closely.

(d) If no attempt is made to measure a grid bearing, but instead an angle from an aiming point is measured on the map, this determination is still burdened with the inaccuracies of plotting three points on the map besides the error of the actual measurement.

(ii) Laying out line with a compass :—

In principle the compass is the ideal instrument with which to lay out line : it is straightforward, portable, and independent of fog or darkness. A gyro compass, reading to 5′, on each dial sight may be a possibility of the future, but until it comes along it must be appreciated that the magnetic compass is subject to the following errors :—

(a) It cannot be read nearer than about 20′.

(b) Its use to determine grid bearings is dependent on a knowledge of the deviation between grid north and true north : and this deviation, though given with a good deal of confidence on most maps, is neither exact nor constant but varies from month to month and also from hour to hour through the day.

(c) The compass needle is subject to local attraction by ironstone etc. in the ground, and to accidental attraction by hidden iron in its neighbourhood : nor is there any easy means of detecting the existence of these attractions.

The above remarks are not intended to indicate that all maps and protractors should be burnt and compasses thrown away. These very methods, whose errors have just been examined, are the correct ones to use in many situations. All that it is intended to show is that they are not good enough for the particular purpose in view, viz : the laying out of a line within the accuracy of the gun.

METHOD TO ADOPT.

Some method must be adopted that will give the required accuracy, and that can be applied under service conditions.

Such a method is to make use of the trigonometrical skeleton on which every map, of whatever scale, is based. This skeleton consists of a framework of points which are fixed, and their co-ordinates known, to a greater degree of accuracy than can be shown on even the largest scale maps.

This framework necessarily exists in any area which has been mapped : but even in a totally unmapped country it is quite practicable to fix sufficient trig points to cover a limited area, say a corps front, in two or three days : whereas it would be a matter of months to draw, reproduce, and issue maps of the same area.

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The positions of these trig points can be issued rapidly to batteries in the form of Trig lists, which give descriptions and the rectangular (grid) co-ordinates of the points: once in possession of Trig lists the batteries are in a position to carry out accurate predicted shoots when required.

APPLICATION OF SURVEY METHODS.

In actual practice the two problems with which the B.C. is faced are generally tackled in the opposite order to that in which they have been set down above: and the processes are :—

A. To lay the guns on a zero bearing (Artillery Training Volume II. Section 21 (1).)

B. When a target is to be engaged, to find the grid bearing to the target and to get the guns on to it by switching off the zero bearing.

These two processes will now be examined in detail.

A. *To lay the guns on a desired bearing.*

It is for this purpose that Bearing Pickets are provided.

A Bearing Picket (B.P.) consists of a socket sunk in the ground, and standing in the socket a picket carrying a label giving the following information :—

(i) The co-ordinates of the B.P.
(ii) The height of its ground line above sea level.
(iii) The grid bearings from the B.P. to two or more conspicuous points visible therefrom.

These will not necessarily be trig points: the chief essential is that they should be easily recognisable, by anyone strange to the locality, from their descriptions on the B.P.

One of the points should be within about 100 metres of the B.P. so that bearings may be turned off, even if the more distant points are obscured by mist or darkness.

The B.P. is used as follows :—

First of all a zero bearing on which to lay out the lines is chosen. A director is placed over the socket of the B.P. and so adjusted that when it is brought round to read zero it will be laid along the desired zero bearing.

A parallel line is then passed down to the dial sight of the pivot gun, or to each gun in turn, and the gun or guns are laid as described in Artillery Training Volume II. Section 19(2) (ii). It is important to take a second director reading to the dial sight as laid down in this section.

There are certain points to notice in carrying out this operation :—

(i) A prismatic compass will often be of use in helping to identify the points whose bearings are given on the B.P.

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(ii) If the point close to the B.P. is used to obtain the bearing, it is important that the director should be centred accurately over the socket: for if the point is 100 yards away, every inch out of centre may produce an error of 1′.

(iii) Whenever possible readings should be taken to at least two of the points whose bearings are given, so as to guard against gross errors which are easy enough to make: e.g. setting or reading an angle 10 degrees wrong on the director.

(iv) If the pivot gun is not visible from the B.P. a second director can be set up in any intermediate position from which both B.P. and gun are visible: the line is passed from the director at the B.P. to the intermediate director and from the latter to the gun.

With care a line can be passed through any number of intermediate stations in this manner without losing more than 1′ or 2′ at each station.

(v) No allowance for displacement is necessary: for the director is laid on a certain grid bearing and the guns are laid parallel to the director and so are on the same bearing. Subsequent bearings on which to shoot are determined for the line Gun—Target (not Director—Target) an so can be switched directly off the zero bearing.

(vi) When the pivot gun has been laid, its line should be checked for *gross* errors by reading the bearing it is laid on with a compass. Or alternatively: the gun may be laid approximately on the zero bearing with a compass in the first instance, and an accurate bearing subsequently passed down to it from the B.P.

EXAMPLE I.

Pivot gun visible from Bearing Picket.

Deviation of the compass, grid north to magnetic north, 12° West.

The grid bearings given on the B.P. are as follows:—

Description of Point.	Approx. Dist.	Grid Bearing.
Brick factory chimney in New Harford	6500 yds.	182° 41′
Nail in corner fence post.	110 yds.	271° 08′
Gap in long wood on sky line.	8 miles	329° 52′

The factory chimney and the nail on the fence post are identified: it is too misty to see the distant wood.

The director is set up and carefully centred over the socket of the B.P.

A zero bearing of 80 degrees grid is chosen on which to lay out the lines.

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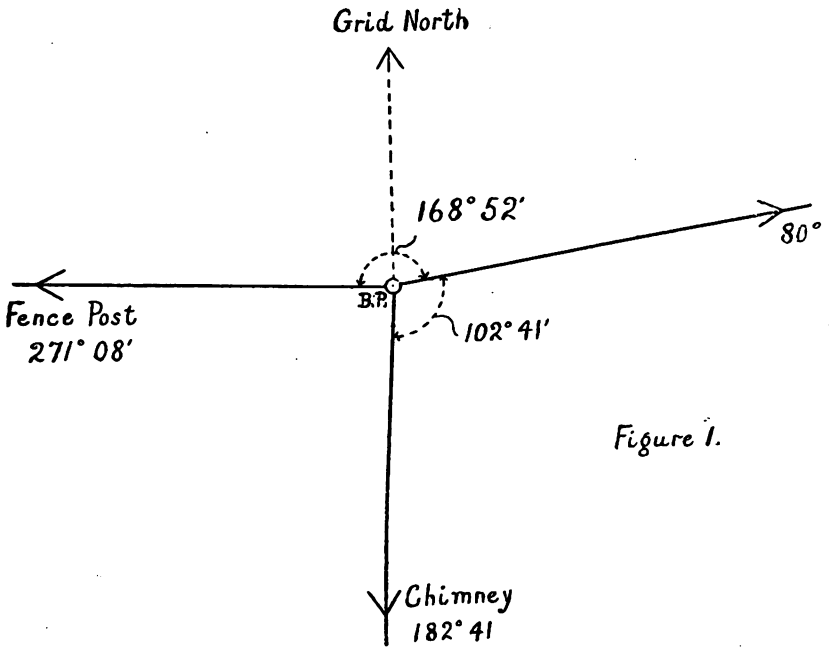

Figure 1.

Figure 1 shows the required angles at the B.P.

An angle of 102° 41′ Left is put on the director which is clamped on the chimney: the reading plate is then turned on to the dial sight of the pivot gun and 131° 23′ Right is read and noted. (See Fig. 2).

The director is then set at 168° 52′ Right and laid on the fence post: the reading plate is again laid on the dial sight and reads 131° 22′ Right, thus checking the work so far.

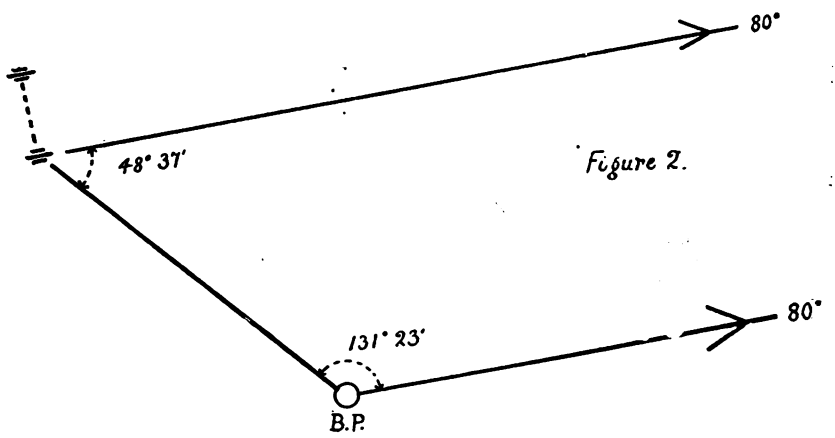

Figure 2.

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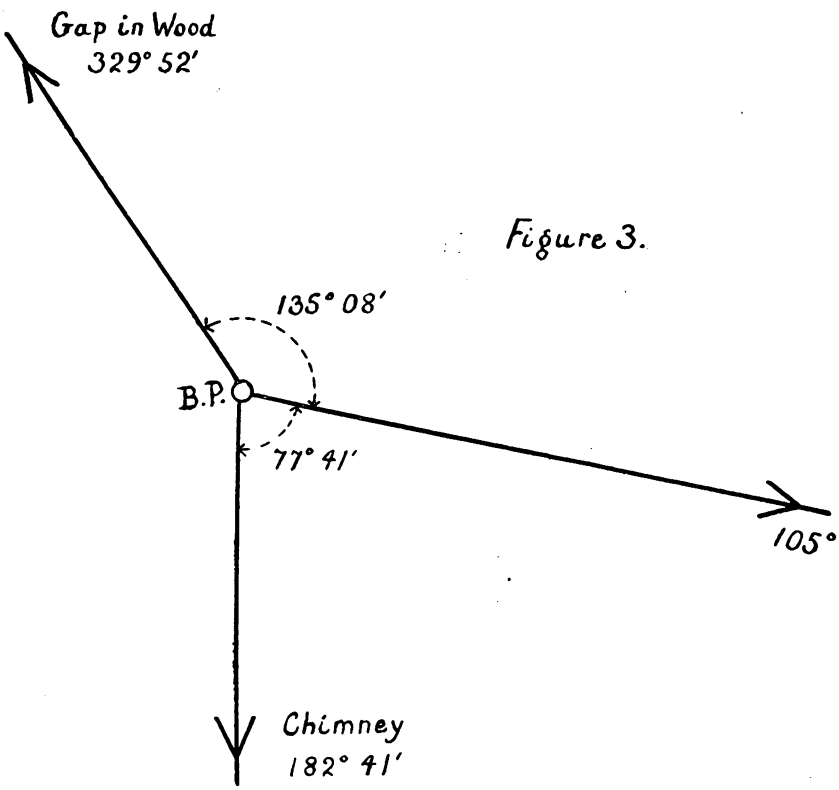
The order is given "No. 1 lay on the director, 48° 37′ Left" : the gun is laid, and a second reading taken to the dial sight with the director and found to be 131° 18′ Right. A second order "48° 42′ Left" is given, the gun is relaid and the operation is complete.

As a check a man is sent out in front of the gun with a prismatic compass and is aligned through the dial sight set at zero : he reads the magnetic bearing to the dial sight as 272½° : this is 260½° grid and gives the line of the gun as 80½° which is near enough for a compass check.

EXAMPLE II.

Pivot gun not visible from Bearing Picket.

Same B.P. as in Example I : all points visible : zero bearing to be laid out 105°.



The director is set up over the B.P. and laid firstly on the gap in the wood at 135° 08′ Right : the check reading is taken on the chimney at 77° 41′ Left.

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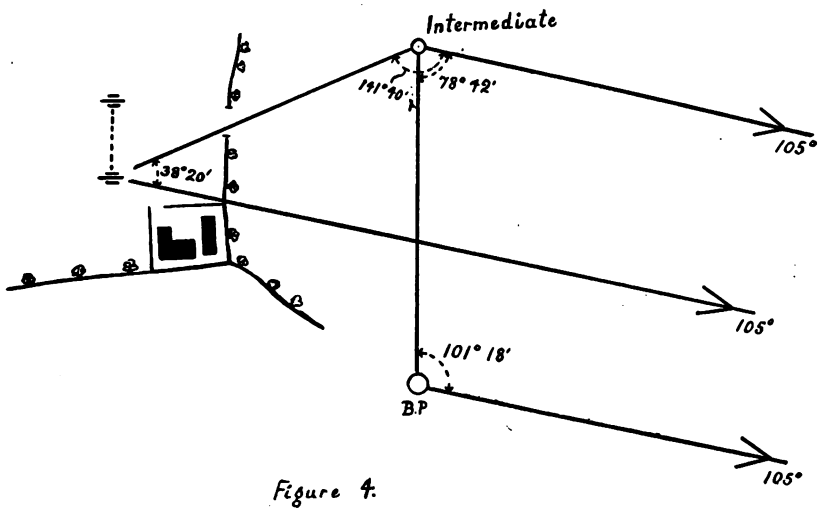

Figure 4.

The battery is in an enclosure and cannot be seen from the B.P. So an intermediate director is put out where the pivot gun can be seen through a gateway.

Angle read at B.P. to intermediate director	101°	18′	Right.
Angle ordered to intermediate director	78°	42′	Left.
Angle read at intermediate director to dial sight ...	141°	40′	Left.
Angle ordered to pivot gun	38°	20′	Right.

B. *To find the grid bearing from the pivot gun to a target.*

To do this we must know the co-ordinates of both gun and target.

Assuming for the moment that the co-ordinates of the target are known exactly, any error in fixing the pivot gun will be reproduced almost exactly by the fall of shot at the target end.

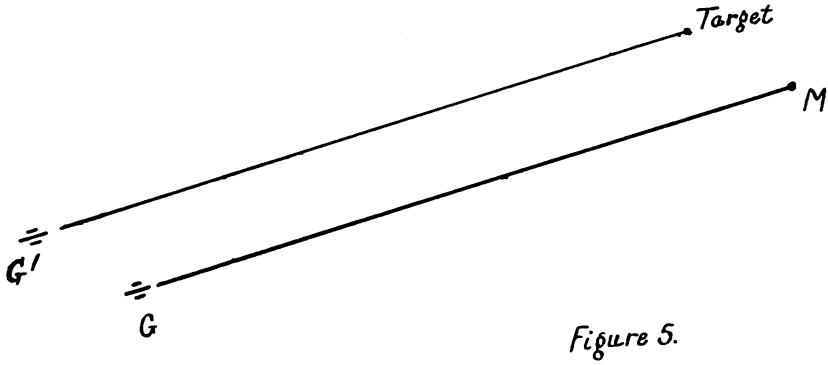

Figure 5.

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In figure 5, G is the actual position of the gun, and G′ is its supposed position, say 8 metres in error : the bearing to the target will be deduced from G′ and will be the bearing G′T. The actual gun G will be laid on this bearing and the M.P.I. will fall at M, 8 metres away from T.

A permissible error of about 10 metres away from the target has already been accepted : so that the gun must be fixed within 10 metres of its true position.

If greater accuracy of laying is required (e.g. for field guns) it is to be sought for by obtaining more accurate fixings of the guns.

It will be noticed that all the permissible error has been absorbed in the gun fixing, and none is left over to cover errors made in laying out the line. This procedure is justified as, from a properly established B.P., a line can be laid out within about 2′.

If, however, any attempt is made to use the gun co-ordinates, which may be 10 metres in error, to compute a bearing to an aiming point, even if the co-ordinates of the latter are known exactly, considerable and unnecessary errors will be introduced, unless the aiming point is really distant. An aiming point whose co-ordinates were known to one metre would have to be about 10 miles away to give the same accuracy that is obtainable by using a B.P.

To find the co-ordinates of the pivot gun.

It is in performing this operation that skill in surveying is of most value. No hard and fast rule can be laid down as to the best way to fix the gun, but each case must be treated on its merits.

Possible ways of obtaining the fixing of the gun are :—

(i) By plane table.

For this purpose the plane table must be mounted with drawing paper, and a plain grid ruled upon the paper. The grids are numbered up in pencil to suit the locality and the neighbouring trig points are plotted by their co-ordinates given in the trig list. If no trig list is issued, but a large scale map is available, points may be chosen on the map and their co-ordinates measured thereon and transferred to the plane table, thus avoiding the distortion of the map : but this will not give such good results as plotting from a trig list.

Batteries do not as a rule frequent high ground from which trig points are visible : so that it is seldom possible to resect the battery position. Usually the plane table has to be taken to some point where a fixing can be obtained, and from there a small plane table survey has to be carried out to fix the gun.

It should not be forgotten that the B.P. itself is a trig point and will often be found useful if plotted on the plane table.

In open or fairly open country the plane table is generally the best instrument with which to fix the gun.

(ii) By map detail.

This pre-supposes that a large scale map is available.

The battery may be so favourably placed with reference to map detail that its position can be pin-pointed on the map and its co-ordi-

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nates measured off from the nearest grid line.

Even if not close to any detail, its position may be obtained with fair accuracy by noticing that it lies on alignments of features on the ground which can be picked out on the map.

(iii) By traversing from the B.P. with a director.

This involves measuring the bearing and distance from the B.P. to the gun.

As there is already a director set up over the B.P. it is very easy to measure off the bearing to the gun by using one or more of the points whose bearings are given on the B.P.

The distance can be found in various ways :—

(a) By pacing. This will give the necessary accuracy if the distance is not more than about 200 metres provided the ground between B.P. and gun is clear. Its value will be improved if several pacings are taken by different people. If the paced distance is up or down a slope of more than 5° it should be reduced to the horizontal by multiplying the paced distance by the cosine of the slope.

(b) By taping. This is straightforward and gives accurate results but is awkward to carry out if the ground is broken or there are men and vehicles moving about in the area.

A taped distance has to be corrected for slope.

(c) By a subtense base. This is nothing more than our late friend the "sub-base" with a few refinements.

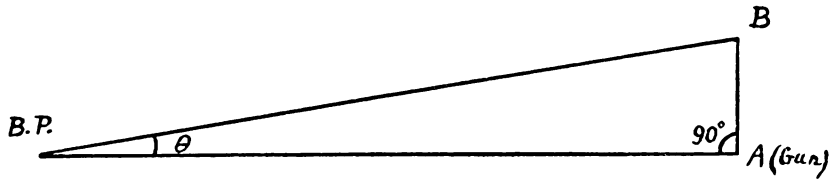

Figure 6.

A known length AB is laid out at the gun position at right angles to the line B.P.—gun. The angle θ which this length subtends at the B.P. is measured with the director, and the distance deduced thus :—

$$\text{Distance} = \frac{\text{A B}}{\tan \theta} \quad \text{or A B} \cot \theta$$

The known length AB may consist of a subtense bar, which is simply a rod with two marks on it at a known distance (say 2 metres) apart : such a bar would be good enough if the distance B.P.—gun was not more than 200 metres.

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Or it may be laid out by taping off a length of 10 metres or 20 metres and putting two marks (aiming posts for instance) in the ground at each end of this length.

The right angle ought to be correct to about 2° and can be got by looking along two adjacent edges of a plane table or a book, or by using the dial sight if the gun is already in action.

A rather accurate determination of the subtended angle is required, especially when using a subtense bar and when taking long shots. This can be obtained even with a coarsely graduated instrument like the No. 4 Director by reading a multiple angle, thus :—

The director is clamped at zero on B (Figure 6) : the reading plate is unclamped and laid on A and the reading noted, say 1° 30′ : the director sight is then laid back on B without disturbing this reading : the reading plate is again unclamped and laid on A : the director sight is brought back on to B, and so on until the point A has been intersected 10 times. The director then reads perhaps 14° 20′ : this is 10 times the subtended angle θ, which is

$$\frac{14^\circ\ 20'}{10} = 1^\circ\ 26'.$$

A table of natural cotangents is convenient for finding the distance from the subtended angle.

The chief source of error in reading a multiple angle is in losing count of the number of times the angle has been multiplied : if the angle given by the first intersection of A is noted it helps to show up a mis-count, but a better check is to take another series of ten readings.

A distance determined in this way with a director whose plate is horizontal, is the horizontal distance B.P.—gun, and does *not* have to be corrected for slope.

Notice that the distance B.P.—gun needs to be more accurately determined if the B.P. is to a flank of the battery than if it is to front or rear. For a bad measurement of the distance in the former case will result in an error in line : while in the latter case it will produce an error in range which is not of so much importance.

Having determined the bearing and distance from the B.P. to the gun, the co-ordinates of the latter may be found by computing its Easting and Northing from the B.P. thus :—

$$\text{Easting} = \text{Distance} \times \text{sine bearing.}$$
$$\text{Northing} = \text{Distance} \times \text{cosine bearing.}$$

The Easting and Northing are then applied to the East and North co-ordinates of the B.P. which are given on the B.P.

Or the bearing picket may be plotted on a plane table, the bearing and distance protracted and scaled off, and the co-ordinates of the gun measured from the grid lines. In doing this it is desirable to use an enhanced scale and to treat each square on the plane table as, say, 10 metres square.

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(iv) By traversing from the B.P. with a plane table.

This is only doing graphically what was done with the director in (iii). The distance may be measured in any of the ways given above and then scaled off along the ray drawn on the plane table.

When the pivot gun is not visible from the B.P. one or more intermediate points (traverse stations) must be fixed, and their co-ordinates determined successively until the gun is reached.

Traversing is a very useful method to employ if a plane table is not at hand or in close country. It is surprising into what an obscure position even two or three legs of a traverse will penetrate.

Careful centring of the director or plane table over the traverse stations is necessary, especially when taking short shots.

Co-ordinates of the target.

In general, for predicted shooting, the B.C. is not responsible for the accuracy of the determination of the co-ordinates of his targets.

If he lands his M.P.I. on the spot on which he has been told to fire he will have done his job.

There are various forms in which he may receive the target co-ordinates.

(i) He may be given the actual co-ordinates of the target he is required to fire on.

(ii) He may spot his target on the map (e.g. harassing fire on a cross road) and measure off its co-ordinates from the nearest grid lines, in which short distance the distortion of the map is negligible.

(iii) Or his target may come to him in the form of a barrage drawn on a map, or on a plain gridded piece of paper. By the use of the latter, a perfectly good barrage, without any gaps in it, can be put down without previous registration in a country of which there is no large scale map, provided the necessary triangulation is made available for use by batteries.

It has sometimes been objected that, if the target is incorrectly located, the only effect of laying accurately on this incorrect location will be to ensure that no rounds fall on the actual target; and that therefore it is better not to attempt to lay accurately.

This conclusion cannot seriously be upheld in view of the following considerations :—

(a) It is very long odds indeed against an error in laying the gun exactly counterbalancing an error in locating the target.

(b) If the fixing of the target is known to be doubtful, effect on it is much more likely to be obtained by laying on its most probable position and then distributing the lines or sweeping a little each side of this position, than by deliberate bad laying.

(c) Once batteries have proved to themselves and to others, at Practice Camps and elsewhere, that they can bring effective fire to bear on any given co-ordinate, it is reasonable to suppose that those who give them co-ordinates of their

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targets will find it worth their while to take all possible steps to give them accurately.

To find the bearing of the line Gun—Target.

Having obtained the co-ordinates of the pivot gun and of the target, the bearing from one to the other may be obtained either by computing or graphically.

By computing.

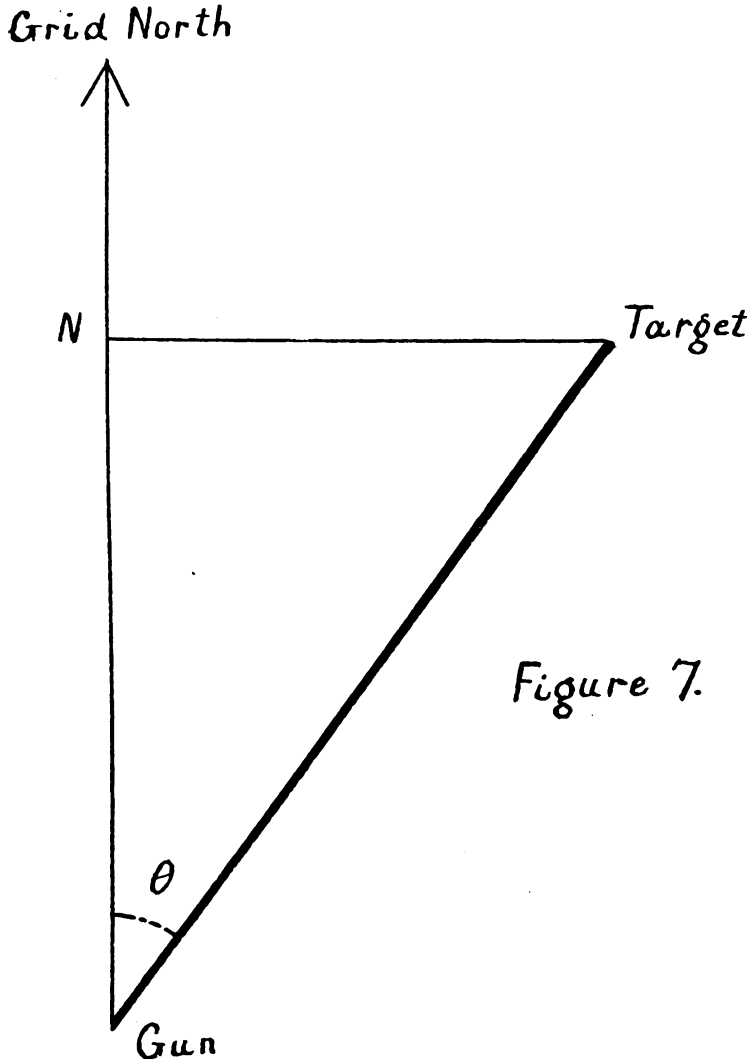

Figure 7.

In the above Figure the bearing G T is given by :—

$$\tan \theta = \frac{T\ N}{G\ N}$$

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T N and G N are both known : the former being the difference between the East co-ordinates of Gun and Target, while the latter is the difference between their North co-ordinates : so that :—

$$\tan \theta = \frac{\text{diff. E.}}{\text{diff. N.}}$$

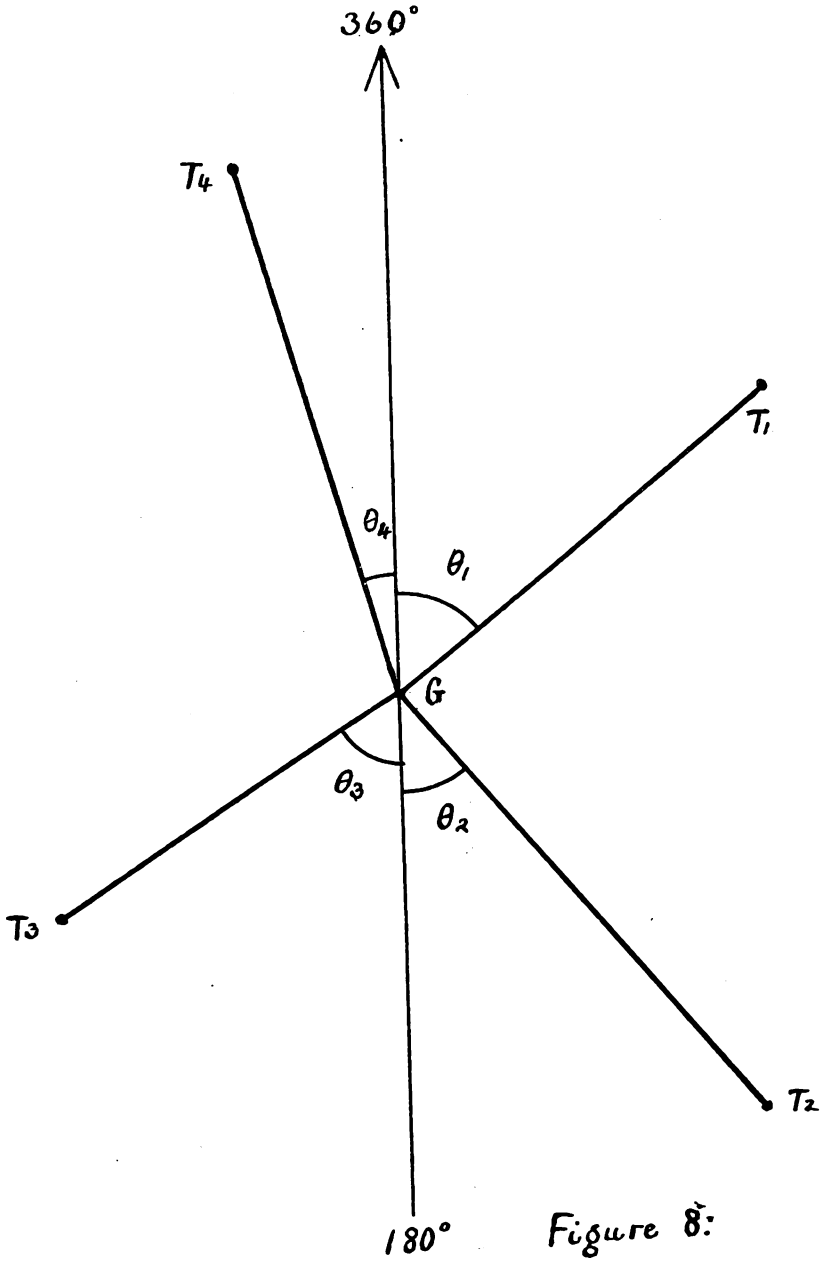

Figure 8.

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The formula $\tan \theta = \frac{\text{diff E}}{\text{diff N}}$ holds good all round the circle, and gives the angles θ_1, θ_2, θ_3 and θ_4 (Figure 8), in the 1st, 2nd, 3rd and 4th Quadrants. Once θ is found it has to be added to or subtracted from 360° or 180° to give the bearing.

Having computed the bearing it is as well to go a little further and compute the range: not only because the range is wanted for shooting, but because doing so gives a check on the computation of the bearing.

Referring to Figure 7 we see that:—

$$\text{Range} = \text{G T} = \frac{\text{diff E}}{\sin \theta} = \frac{\text{diff N}}{\cos \theta}$$

The range should be computed both ways and the two values obtained should tally: the fact that they do so checks the whole computation, *except for the initial subtraction of the co-ordinates.*

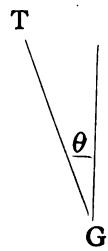
As a further check, the gun and target may be plotted on a grid and the bearing gun-target measured with a protractor.

Four figure logarithms are suitable for the computations.

EXAMPLE.

Co-ordinates.

	East.		North.
Gun	275,415 metres		93,355 metres
Target	273,720 metres		98,520 metres
Diff. E.	1,695 metres	Diff. N.	5,165 metres



Log. diff. E. 3·2292
Log. diff. N. 3·7130

Log. tan. θ = 9·5162

θ = 18° 10′

Bearing = 360° − 18° 10′ = 341° 50′

Log. diff. E.	3·2299	Log. diff. N.	3·7130
Log. sin. θ	9·4938	Log. cos. θ	9·9778
	3·7354	= Log range =	3·7352

The two values for the range tally near enough: convert to yards and take out the anti-log.

3·7352 metres.
·0389 add for yards.

3·7741 yards.
Range = 5944 yards.

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Graphically.

The position of the pivot gun is plotted on a gridded board. An arm is pivoted over the gun position and an arc is drawn, or a metal arc fixed down, on the board to read grid bearings from the gun position.

Targets are then plotted by their co-ordinates, and ranges and bearings are read off with the arm and arc.[1]

In the extreme case of trench warfare, a map may be cut up and pasted down on the gridded board. There will seldom be time to do this, as unless the map is pasted down with the utmost care considerable errors are likely to be introduced.

Comparison of computed and graphic methods.

Computing is accurate: necessitates only log book, paper and pencil which can be carried in the pocket: and in practice is almost as rapid as plotting and measuring graphically.

Measuring the bearings graphically is straightforward, but necessitates a gridded board with arm and arc. It is not so easy to use in cramped places, or in bad light or bad weather.

The chances of making a blunder are about equal in each method: viz. of subtracting the co-ordinates wrongly in the one case, or of plotting the target incorrectly in the other.

SURVEY APPLIED TO GUNNERY.

The application of survey methods to laying out accurate lines of fire has been set out at some length. It must not be assumed from this, however, that these methods are necessarily slow in use.

Provided that the necessary survey data are available, to lay out accurate lines with a Bearing Picket is quicker than to register a battery on a zero line, and has the following additional advantages:—

(i) It does not disclose the position of the battery prematurely as registration does.

(ii) The lines can be laid out, auxiliary aiming points for the guns to lay on picked up, etc. before the arrival of the guns, which can be brought into action at the last moment.

(iii) All the necessary operations can be carried out in thick weather or in darkness if necessary.

The essential principles involved in the formal use of trig points and Bearing Pickets are:—

Firstly, that the battery is fixed with sufficient accuracy to determine the bearing to any target.

Secondly, that a line is passed down to the battery from a point where accurate bearings can be turned off.

Once these principles are grasped the best use can be made of a map when that and that alone is available.

[1] The Artillery Board is designed to enable this to be done conveniently. With a carefully prepared Artillery Board it is possible to read the bearings correctly to 2′ or 3′.

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For suppose a battery to have been brought into action in an enclosed position from which no good aiming point is visible, and it is desired to lay out accurate lines. A good enough fixing can be got for the battery from surrounding map detail, while the director can be taken to some point (such as a cross roads) which is likely to be well fixed on the map and from which a distant aiming point can be seen. The director can be treated as a B.P. : the bearing to the aiming point can be computed : and any desired bearing passed down to the battery.

The above is only one illustration of the fact that emerges; viz. that survey and gunnery are really a single study and cannot be kept in water-tight compartments.

CONCLUSION.

These notes have dealt only with the survey methods now in use in the service.

In the late war these methods were both developed and applied for us by trained Royal Engineer surveyors: it was their use that enabled such surprise artillery attacks as those at Cambrai and on August 8th, 1918, to be made.

The responsibility for the further development of Artillery Survey to keep pace with the evolution of equipments or tactics now rests solely with the Artillery, who are also responsible for the provision of the survey data necessary to the survey operations that have to be carried out by batteries.

Unless the Regiment as a whole takes steps to make itself self-supporting in these matters it will not be able to apply that maxim of the most famous of all Artillery officers, which is set out at the head of this article, and which holds good with equal or even greater force to-day than when it was first enunciated.

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NOTES ON ARTILLERY ORGANIZATION.

(1). Organization in war depends on the possibilities of command and administration. These possibilities are limited by the capacity of one man's brain, the facilities for communication, and the degree of movement that is going on.

The object of organization is the tactical efficiency of troops in battle.

(2). The principle of the employment of artillery, as of other arms, is the development of its maximum power at the decisive point at the right time. Its organization must enable this principle to be put into practice in any circumstances which may arise, and must be adaptable to a force of any size from a group of armies downwards.

(3). Tactics are a combination of fire and movement.

Artillery is capable of a greater volume of fire on a given front than an equivalent body of troops of other arms, while its fire can be applied over a greater space on the ground or in the air, without movement. On the other hand, it is tactically inoperative when on the move. For this reason it is unable to decide a combat by itself, and is of necessity an auxiliary to other arms which have that power.

(4). In order to ensure the highest degree of assistance two conditions must be fulfilled :—

(a) The attainment of the maximum radius of action of which the range and shell power of the guns are capable.

(b) The maintenance of constant and close touch with the other arms whose action it is supporting—whether cavalry, infantry, tanks, or aircraft.

Of these conditions, the former demands centralization of command for concentrated effort, and the latter decentralization for local operations. Undue decentralization of artillery command limits the use of guns to a narrow front, particularly with the heavier guns in view of their greater range and radius of action. On the other hand, if command is over-centralized co-operation with the other arms will be slower and, therefore, less effective.

(5). Hence in order to ensure flexibility of command the amount of artillery *which is an integral part of any formation must be cut down to the lowest possible limit.* This is necessary in order to avoid the moral and administrative disadvantages of detaching units from one formation, and thus dislocating its organization, in order to reinforce another. Artillery reinforcements and concentrations should be provided from a fluid reserve in the hands of the higher command. This principle was followed by Napoleon for tactical reasons in the use he

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made of guns at Friedland and at Wagram, and was justified over and over again during the late campaign in France from every point of view. It was, of course, the reason for the introduction of Army Brigades and for retaining G.H.Q. Control of all Heavy Artillery; and for parallel reasons Anti-Aircraft Defence was organized by the Army H.Q. Staff.

Artillery organization must in fact be elastic.

(6). It has always been a difficult problem, however, to decide what the smallest formation possessing artillery of its own should be, and how much artillery it should have. Since 1870 the smallest formation so organized has been the division, but the number of guns allotted to a division and the organization of the remainder, in the British, French and German Armies, has always varied considerably.

The following are some of the principles which affect questions of artillery organization.

(a) No formation should have more "organic" artillery (i.e. artillery which is an integral part of the formation) than is necessary for normal defensive support of the infantry in "Continental" warfare, in other words for "holding the line". It will always be necessary to reinforce before making an attack, or to resist a foreseen attack by the enemy, and the reinforcing artillery whether field or heavy, must be drawn from a fluid reserve in the hands of the Commander-in-Chief.

(b) No formation which is variable in magnitude, such as an army or a corps, should possess artillery of its own.

(c) On the other hand, in order to avoid the loss of power which results if command be unduly decentralized, artillery should not form an integral part of too small a formation. For instance, assuming that the brigade of four batteries is the artillery tactical unit, it would have been unsound during the war to make permanent "brigade groups" of a brigade of infantry and a brigade of artillery, because the fire of the artillery might have been restricted to the front of its own group, although capable of covering other portions of the front of the Division.

But the development of Tanks and motor traction generally will doubtless lead to economy in man power, and the 4,000 infantry which compose a brigade, duly supported by tanks and artillery, may soon be able to attack or defend a front which would now be allotted to a division. When this happens the relative organization of all Arms will have to be readjusted.

(7). It is for consideration therefore :—

(a) Whether the division, as we now know it, is satisfactory in view of the great quantity of ammunition and technical stores necessary in modern war, and the consequent increase

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in the road space occupied on account of additional transport: or whether this contention may be modified by the use of cross country tractors for transport, which would enable the formation to move more or less deployed.

(b) Whether the present scale of divisional artillery requires modification, either as to number or nature of guns, from a tactical point of view; and whether, if a smaller formation is adopted instead of the division as at present organized, the new formation should have any artillery of its own, and if so, how much.

(8). Of the questions put forward above :—

(a) Is a general question beyond the scope of this paper, but it may be remarked that artillery ammunition and forage takes up a very great deal of transport.

As regards (b), we had acquired sufficient experience towards the end of the war in France to be able to estimate the strength of artillery required on a given front for attack and defence in "stationary" and "semi-mobile" warfare.

In this connection, it is to be noted that the employment of artillery can only be discussed in all its bearings in relation to the warfare of very large forces.

Indeed the greater problems of a "Continental" war, which will always entail the attack and defence of prepared positions, include the lesser problems of a "small war".

But the increasing efficiency of Tanks, and the development of Aircraft have made it necessary to review the remaining value of our recent war experience, and the conclusions drawn from it.

(9). The average minimum strength of Field Artillery necessary as things are at present to cover an attack on a prepared position may be taken as one field piece (i.e. 18-pr. or 4·5″ how.) for 20 yards of front, and the average front of attack of a division as 3,000 yards. Hence 150 field pieces would be necessary to support the attack of a division, which is approximately 6 brigades, R.F.A., as they are now organized for a "Great War": in other words, the divisional artillery and three additional brigades.

In defence when no hostile attack was imminent, and with the initiative in our own hands, a division was expected to hold as much as 11,000 yards of front with an artillery strength of one field piece to 150 yards, that is to say, three brigades, R.F.A., or a complete divisional artillery. It was on this latter assumption that the quantity of divisional artillery recommended by the Bird Committee was allotted, and it is probably the right basis on which to calculate the irreducible minimum. (See para. 4).

(10). The calculations for offensive strength given above are based on the final "semi-mobile" stages of the late war when tanks were largely used, and when the morale of the German Army had

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deteriorated. The latter is an important point.

They take no account of heavy artillery which was always at at the disposal of G.H.Q. as far as *allotment* was concerned, and for *tactical purposes* was mainly (railway guns and 12″ Hows. are exceptions) under Corps Control. Experience proved that it was unsound to allot it to lower formations except during movement, as this led to its being used "parochially". (See para. 4.)

(11). The proportion of field pieces (i.e. 18-pr. and 4·5″ how.) to infantry in our army during the war was as follows :—

1914	6	guns to 1,000 infantry.
1918	7·7	guns to 1,000 infantry.
at present	8	guns to 1,000 infantry.

(12). We have, therefore, to determine the effect of new methods, and particularly of the use of Tanks, on the relation to frontage of men and guns in attack and defence, and from our deductions to modify the existing organization of artillery if it appears necessary.

It should be remembered that no tactical questions can be considered independently of administration and that the tendency of modern warfare is constantly to increase the amount of ammunition, stores and equipment required to carry it on.

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SHRAPNEL AND TIME FUZES.

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

[*Note.*—Some of the arguments deduced against the employment of shrapnel shell are far from convincing. It should, however, be remembered that the German shrapnel shell was distinctly inferior in design and general efficiency to the British shrapnel.]

THE training section of the Reichswehr-Ministry sets problems every year to be solved by the Officers of the various arms. This examination appears to have the objects of (1) testing the professional capabilities of Officers; (2) encouraging professional studies, and (3) collecting opinions on important points. The main point is the first mentioned and, accordingly, the examination includes various tactical questions, problems in fortifications, sketching, map-reading, military history, economic geography, foreign languages, mathematics, and science, as well as armament and equipment.

In 1921, the problems for Artillery Officers under the last head were; "Can light Artillery dispense with shrapnel and with time fuzes". The recently published comments on the papers deal with these two questions as follows :—

The opponents of the retention of shrapnel for light artillery take the view that shrapnel can be entirely replaced by explosive shell with sensitive (instantaneous) fuzes, delay action fuzes (for ricochet action), and time fuzes (map shooting and ranging for line), and by canister shot. They put forward the following arguments :—

At over 3000 metres range, the effect of shrapnel is frequently insufficient. This is explained by the loss of striking velocity, by the steeper angle of descent and, above all (sic!), by the fact that, for example, skirmishers hear the report of discharge before the shrapnel bursts and can throw themselves down so as to offer a limited target.

The penetrating power of the balls, especially if they are made of steel instead of lead, is insufficient. This is especially the case with horses and with an enemy in winter clothing.

The possibilities of taking cover or avoiding shrapnel fire are much greater than in the case of shell-fire with H.E.

The moral effect of shrapnel-fire is smaller than that of high-explosive shell, which is due in large measure to the small report of the detonation of shrapnel in addition to the reasons given above.

If it is impossible to regulate the height of burst, the shrapnel shell loses appreciably in effect. Bursts which are too high have little

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effect; bursts on impact practically none. Hence, shrapnel cannot be used in the numerous situations in which it is not possible to regulate the height of burst, (e.g., when shooting by night or with low visibility, fire preparatory to an attack, searching behind crests and woods).

The value of shrapnel for enfilading trenches and roads is over-estimated. For example, trenches can only be enfiladed when they lie exactly in the line of fire; but, even so, modern trenches, with their irregular form and numerous traverses, make an effective enfilade problematical. Roads, which are under observation within shrapnel range, bear little or no traffic in daytime, i.e., when it is possible to regulate the height of burst.

The use of the shrapnel time-fuze necessitates a different procedure to that of H.E. percussion fuze. Therefore the training manual would be much simplified by the abolition of shrapnel. Above all, it is much easier to master the art of shooting with H.E. percussion fuzes and delay action fuzes (ricochets) than that with shrapnel time-fuze; this is of great importance in war, when one must reckon with less well-trained forces.

The difficulty of storing large quantities of shrapnel in position warfare, so that the time-fuzes, which are subject to the influences of the weather, are adequately protected, must not be under-estimated.

The mass-production of a reliable time and percussion-fuze was a failure in the war owing to the lower care and skill of the labour available.

The incendiary effect of percussion shrapnel was wrongly estimated in peace time. Straw-stacks should be fired with H.E. shell, not with shrapnel; in the same way, at short ranges, H.E. shell have a better incendiary effect on thatched houses than shrapnel shells.

H.E. shell with delay action fuze is more effective against masonry than shrapnel.

On the other hand the retention of shrapnel is urged because :—

Shrapnel with time fuze is excellent for use against visible living targets up to 3000 metres range. Its claim to existence is based on the requirements of moving warfare. Stationary warfare is responsible for a reduced estimate of its value; but every power, when at war, will seek a decision in war of movement and in that shrapnel has fully substantiated its claim to existence.

The long forward-effect of shrapnel facilitates the searching of a large area, by the simultaneous use of various ranges, in a shorter time than is possible with H.E. shell. That is very important in the case of surprise fire on fleeting targets.

The advantage of the forward-effect of fire makes itself felt particularly against targets formed in depth. Every modern infantry attack offers such a target.

Shrapnel is of increased importance in situations in which the effect of H.E. shell with impact or delay-action fuzes is limited by the terrain or situation. Such is the case on marshy ground, on terrain

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covered with thick undergrowth or bushes, and at ranges up to about 1200 metres, i.e., at the decisive point of the battle.

With shrapnel at short ranges, suitable fuze-setting produces a grape-shot effect,—the most favourable fire effect for close-fighting.

The difficulty, which is alleged to have existed towards the end of the war, of achieving good results with the shrapnel time fuze, was chiefly due, not to insufficient training, but rather to the impossibility of regulating the point of burst with the badly burning fuzes. The English artillery is a proof of this, since, owing to superior fuzes, it could place the point of burst with absolute precision and obtained good effect. The English were, however, hardly better trained.

Weighing up the evidence of the opponents and supporters of shrapnel, one comes to the following conclusion :

If we do not succeed in manufacturing a thoroughly efficient shrapnel shell, with lead bullets and a fuze, which is independent of weather influences, and satisfactory powder in mass production, with less skilled workers, then the light artillery must dispense with shrapnel. If, however, it is possible to make such a shrapnel shell, for which a loud detonation is also desirable, then it should not be abandoned, for that would mean giving up a projectile, which, in special cases, is decidedly superior to H.E. shell. For the present, therefore, we cannot dispense with shrapnel.

The second part of the question, as to whether the time fuze can be dispensed with, is to be answered in the negative.

The time-fuze is absolutely essential to make calibration for map-shooting and testing lines of fire possible. With this object, some of the shells, including the "C" projectiles, must be provided with time-fuzes. Shooting for effect with H.E. time-fuze is seldom required, since the introduction of shooting for ricochet effect. The rarity of such cases would certainly not justify providing all shells with time and percussion fuzes. The H.E. time-fuze will be used for effect only against air targets.

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HOW SHALL WE SHOOT OUR BATTERIES?

ALL shooting can be classified under two distinct headings, i.e. shooting that can be observed and corrected, and shooting that cannot be corrected.

From the artillery point of view there was certainly no more striking feature in the late war than the continual development of blind, unobserved, map or, as it is now called, predicted shooting.

With the increased size of the modern battlefield, pre-arrangement of movement, in tactics of attack, (as opposed to spontaneous movements), became necessary, and with it pre-arrangement of artillery fire. If a Wellington or a Napoleon were to ride into the thick of a modern battle to "see for himself", far from being able to order the advance of a division or a corps and thereby win the battle, he would inevitably forfeit control of the situation as a whole—and lose it. Add to this pre-arrangement of artillery fire, that the power of modern weapons makes attack at dawn or dusk (or in smoke—artificial dusk) almost imperative to minimize losses. Under other than the very best conditions, observed artillery support on the scale now required is impossible; and it is precisely these conditions, of light and nature of country for example, which are unfavourable to troops attacking an enemy armed with modern weapons. These conditions must therefore be absent, and the artillery must resort to some form of predicted shooting.

A time table for the attack then—but in defence the time table is in the hands of the enemy. Pre-arrangement of artillery fire in defence would seem to pre-suppose knowledge of the enemy's plan of attack, and this would be an unwise assumption. Plans can and must usually be made for some sort of pre-arrangement of artillery defence; for ordinarily the enemy's attack must be within certain prescribed limits, and probably at dawn or dusk when observation of artillery fire will be impossible. Such pre-arranged fire, however, can only be prepared against the first onslaught; subsequently the difficulty of communications, the decentralization of control and the uncertainty inherent to all withdrawals prevent predicted shooting from being, in most cases, other than waste of ammunition. Fire must be observed and corrected.

There is a great deal of fighting that lies midway between attack and defence. The "encounter" battle is of this nature; and also the day to day fighting in stabilized warfare for the purpose of maintaining contact, pinning the enemy to his positions and getting information. For these affairs much artillery fire cannot be spared. The importance of variation of gambit, and grasp of opportunities of time and place, as

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well as the impossibility of allowing much artillery ammunition for minor enterprises, necessitate that a great part of this artillery fire should be observed; for tolerable certainty of effective predicted shooting can only be obtained with a lavish expenditure of ammunition. And again, extreme accuracy can never be expected of predicted fire. Where defences or obstacles are to be destroyed, fire must be observed. Also in order that accurate predicted shooting may be obtained, much observed shooting must be done to test zero lines, calibrations and for datum and witness point purposes.

There is also an incidental value in observed shooting. The keen lookout of the artillery observer not only provides most of the information from ground sources so much required by the commander in rear, but also hampers very seriously the enemy's reconnaissance. It is often said that at least ninety per cent of gun fire casualties are caused by predicted shooting. But the balance claimed by observed shooting are the bold spirits that lead the way— the ones that no army can spare.

It was intended less to point out the merits of good observation backed by a good shooting battery, than to outline its changed conditions. The exploitation of aerial possibilities also alter these continually. There are however certain physical facts which do not change. The range of guns increases but the vision of human eyes gets no longer, and the early morning light looking eastward gets no better.

2. *And hence the forward observer.* This term is meant to describe the artillery observer who, in order to get a closer view of his targets, gets well forward from his battery position. Not necessarily a subaltern sent forward for a special purpose; in fact very soon after coming into action the main observation post of the battery, or in the case of masses of artillery of the linked batteries, brigades or group. In some types of warfare the battery commander will undoubtedly continue to find an observation post from which he can see his target area, and will bring his battery as close to it as possible. But in the face of an active hostile artillery, if the range of the field gun is 10,000 yards and the distance at which friend can be distinguished from foe with glasses in European light and in moving warfare is 3,000 yards, will the battery commander risk bringing his battery up to within shouting distance of his O.P? There are also the considerations that batteries at 6,000 yards can cover twice as wide a lateral zone as guns at 3,000 yards, and have twice the chance of "living to fight another day," if the tables are turned and the enemy makes a successful attack? and so we arrive at the problem of

3. *Communications.* A telephone is a wonderful thing when all goes well—thrice accursed when things go wrong. How much wire can a battery carry so that it can be ready for use in a war of movement? A lighter wire than forty pounds to the mile is useless: it only enables the local cows (French or otherwise) to play such games as Montmorency played with the towrope in "Three Men in a Boat"; and

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the infantryman who walks into it in the dark can break it with a kick. Again how much time can be spared to lay out long lines—perhaps to take them up in a retirement? Voice control is a special case and, valuable as it is at times, was shown by the late war to be exceptional: the noise alone of a modern battle limits its usefulness. The telephone is a very valuable accessory and the best means of communication, but a luxury and not for always.

So next to

4. *Visual and electrical signalling.* Of pre-war armies the British was exceptional in the faith that it had in such methods before the war. And why? Because they were thought unsuitable for a conscript army. The war confirmed their value and their difficulties alike; the batteries of the late war had many efficient telephonists but few good signallers. Semaphore—the speed of the racecourse tic-tac—at short range. Morse—lending itself to an infinite variety of methods—flag, shutter, helio, lamp, all visual; then earth current and wireless. The strides made in wireless since the war have reduced the weight of the set to be carried, while increasing greatly its reliability, and the number of sets that can be used on any given frontage. Probably the only hindrance to their immediate introduction as part of the equipment of a battery are the expense, and the certainty that in the present state of development, invention would put any such equipment out of date almost before it could be issued.

Developed to the full they provide a nervous system which annihilates the space between the observer and the batteries: the nerve that tells the brain that the eye sees and that the hand touches; the nerve that causes the hand to grasp.

But how to annihilate the time taken to pass these messages? The morse and semaphore codes are not taught in the national schools. And so on to

5. *Training of signallers.* It is granted that when training settles down it will be possible with the available material for Regular units to be provided with signallers of the pre-war standard, and probably more of them.

Now at this moment one European army at least trains not for war nor for *a* war, but for *the* war; and who will say that wars in Europe are over? The greater, even if less likely, must include the less.

So in anything so important as the network that is to help the dispersed units of an army to co-operate—of a national army to co-operate (nations fight now, not armies)—thoughts must pass beyond the four divisions of the regular army to the first fourteen divisions of the Territorial Army, and then to the second fourteen and the Territorial Armies of the sister nations of the Empire, and more besides. Will they be able to train signallers up to the pre-war standard or better, not for the signal sections but for the units, in the numbers required? There may not be a year to do it in (the first twelve divisions

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of the "New Army" were formed in September and October 1914 and their first big battle was Loos in September 1915). So on to

6. *Correction of fire by signal.* The essence of observed shooting is speed. The targets that the artillery observer lives for, the targets the gunner subaltern going to his first war dreams of (most of us *dreamt* of) are not trench junctions or some wretched Belgian farm; but hordes of square pack forms blackening a field that for hours previously had been as bare as the chart in the "Hunting of the Snark", or suddenly changing the level outline of a crest into a scene like a bit of real Gorgonzola. How to make the most of this chance of our dreams when it at last comes true? And so on to another problem

7. *Shall the observer send observations or corrections?* Before the war the method in which the observer reports the target and sends observations of fire, would have been scouted. But where, as probably often in future, maps allow locations to be fixed and described, this alternative must not be brushed aside. It must for some time to come remain the normal fleeting opportunity method of that valuable artillery observer—the R.A.F. pilot. The ground observer also often finds himself so placed that he cannot get continuous observation on the target, and at the same time maintain continuous communication with his battery. There seems no reason why he should not report targets and send observations in more or less the same way as the aeroplane observer. When the question of multiplication of codes is considered presently, the advantage of this will be obvious.

The common case is that a target cannot be seen from any point within close touch of signalling communication with the battery. Here some such procedure as that of the NF and ANF calls in which cases the batteries wait a definite time after getting the call before opening fire, would be useful; the delay allows the observer to get back to the point from which the target can be seen, and observations can therefore be sent. Calls of such natures as the LL and GF calls would be of great value to enable the observer so placed to put not only his own battery but a whole brigade or group on to any important quick target.

There has been much discussion as to the possibility of the ground observer giving observations on the "oriented clock code" system used with aeroplane observation. While many consider the degree of accuracy likely to be obtained will not be great, this still remains without a serious rival as a means of sending observations of fire. The North—South line certainly cannot be visualized on foreshortened ground; yet from an observation post with good command an observer practised in this method can certainly give valuable observations.

But experience has taught, and all opinion in the British army agrees (all continental armies do not) that if the observer can get continuous observation and pass continuous messages, better results will be obtained by the observer controlling and correcting the fire of guns, than by an officer at the battery controlling and correcting fire on the

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observer's observations; and on this principle is the practice of the direction of fire in observed shooting based. So on to

8. *How shall the observer send his shooting messages?* As a first choice by speaking telephone, or its wireless equivalent when it comes. But under certain circumstances telephones will not be available and under others they are unreliable. In moving warfare long lines cannot be run out continually; in warfare in which the enemy has much artillery at his command, telephone lines cannot be expected to escape damage. Signalling by flag and semaphore is very quick and simple, but can of course only be used when the battery and the O.P. are visible from each other and at short distance; these are the conditions under which it should usually be possible to maintain a telephone line. Morse signalling by visual means, flag, lamp, helio or shutter lends itself to all different circumstances so long as the battery and O.P., as before, can see each other. In enclosed country, over great distances and in bad light, or at dusk or dawn, wireless or earth current wire provide an excellent means of communication.

Taking into consideration the best targets for observed shooting, it cannot be denied that the usual methods are inapplicable and the necessity of shortening the messages required to fire a "series" becomes imperative. Before the war a list of abbreviations in F.A.T. was used for this purpose. To apply this to modern requirements and the different natures of artillery to be expected on a modern battlefield, it would require considerable amendment and probably amplifications; it might still suffice for the signallers of the regular army, dependable at sending morse messages at (say) twelve words a minute with any means at hand. But can this be expected of our signallers in the next big war if it comes—and the army exists as such in case it may come? Can this degree of training be expected of the signallers of a Territorial Army, of a war-time-enlisted national army and of the overseas forces? Those targets of our dreams would have to go slow.

9. *The "Artillery Code."* This code was introduced in the end of the late war for the purpose of reducing the number of messages that had to be sent to shoot a battery when using visual. The standard of signalling was not high—even after four years of war and two of compulsory service. The 1914 F.A.T. abbreviations had been found to be insufficient, and had been twice amended. It seemed likely that the code would have fulfilled its purpose had not the war ceased; it has at all events had one good result in that it has brought about the "standard orders".

The code was intended to replace the abbreviations in so far as they help a B.C. to send his shooting messages; and above all to cut out the necessity for sending numerals. The examples shown, taken impartially out of A.T. Volume II, Chapter VIII, make clear the difference in the number of signals that must be sent in each case (i.e. 1 for $2\frac{3}{4}$ to 3). When an FFFF message (once DDDD) is sent and all signals must be repeated three times, with the old abbreviations there

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would soon be a shortage of message forms—but there would be very little shooting. Also by the use of the Artillery Code the procedure is simplified, and a list of abbreviations for the purpose of sending shooting messages need not be learnt. It was never intended that even the most frequently used groups should be memorised, and probably any such tendency is dangerous.

Ex. II.	F.A.T.	Artillery Code. CCC.
No. 1 Take Post.	FI.1.FF.ZZ.	HA.AA.
Target, a house.	ZZ.	TK.
Fuze 106, cordite charge 5.	ZZFI101.FF.FC.	AC.AY.
3° Left of Zero Line.	FI.3.DEG.FF.L.	CF.
Angle of Sight 30′ El'v'n.	AS.FI.30FF.MIN.EL.	FH.
No. 1 ranging gun.	FI.1.FF.RGN.	HA.HI.
5600 fire.	FI.56FF.FIRE.	MR.RF.
30′ M.R.	FI.30FFMIN.RT.	UH.
5601.	FI.56.FF.	MR.
5200.	FI.52.FF.	MN.
5400.	FI.54.FF.	MP.
5300	FI.53.FF.	MO.
5300	FI.53.FF.	MO.
5400.	FI.54.FF.	MP.
5′ more left.	FI.5.FFDEG.RT.	WA.
5350, 3 rounds gun fire.	FI.5350.3FFRDS.GF.	MOY.HP.HZ.
40 seconds.	FI.40FF.SEC.	II.
4 rounds gun fire 40 secs.	FI.4FFRDS.GF.FI.40. FF.SEC.	QH.HZ.II.
Record, empty.	REC.ZZ.	TN.RB.
	163 Signals.	60 Signals.
Ex. VII.		
Target, infantry.	INF.	DM.
6° Right of Zero.	FI.6.FFDEG.RT.	BI.
Angle of Sight 10′ el'v'n.	AS.FI.10.FF.EL.	FB.
37—34.	FI.37.34.FF.	LT.LP.
Fire.	FIRE.	RF.
All guns 5° More Right.	ALL.FI.5.FF.DEG.RT.	UQ.
Corr : 148.	CORR.FI.148.FF.	JN.
3300, 2 rounds.	FI.33.2FF.RDS.	LO.HD.
Gun fire.	GF.	HZ.
Corr : 140, 2 rounds.	COR.FI.140.2.FFRDS.	JJ.OH.
Battery fire.	BF.	HX.
No. 4 Parallel lines to No. 2.	FI.4.FF.PAR.TO.FI.2.FF.	HF.TI.HB.
All guns 3° M.R.	ALL.FI.3.FF.DEG.RT.	UO.
Drop 200, 6 rounds.	DROP.FI.200.6.FF.RDS.	XZ.HT.
Gun fire 10 secs.	GF.FI.10.FF.SECS.	HZ.JC.
	139 Signals.	45 Signals.

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Where F.A.T. 1914 gives no abbreviation ZZ has been substituted for the purpose of counting signals.

As against these advantages must be set

(i). A copy of the code must be carried.

(ii). Time must be spent encoding and decoding.

Probably the first is not too much to ask. If the code is to be kept it can be incorporated in the range table. The question of encoding is not so simple. Until the use of the code is understood, it is best that encoding should be done by an officer—preferably the officer doing the shoot. The messages are arranged in the sequence of orders; but it must be conceded that details of the present arrangement leave room for improvement and that the instructions require re-consideration. Above all it is important to keep out of the code groups that might be used for sending information or observations of fire (as opposed to corrections); such groups greatly increase difficulties of encoding. And now to the question of

10. *Codes in general.* A.T. Volume II contains a code (A) of forty-eight symbols—some of which are abbreviations—for the purpose of sending information or observations from an aeroplane to the ground. A code (B) for the purpose of signalling by means of ground strips from the ground to the plane (eighteen or nineteen symbols). A code (C) for sending messages from the ground to the air by means of wireless or lamp; this code has been little used and will not be discussed.

Code (A) must be memorised by the observer and by the receiving personnel—at present the battery officers.

Code (B) signals are ordered by the battery officer, and must be familiar to the observer. It is to be hoped that wireless personnel will be supplied by the batteries in the near future, and certainly in the next war. In this case the battery signallers will have to know these two codes.

The F.A.T. 1914 list of abbreviations consisted of sixty-four signals; this was expanded into approximately one hundred and five signals in an Army Order of 1917, and to roughly ninety-six signals in 1918. If Artillery Training is to apply to all natures and this list is to be brought into line, it would require further increase; it is also true that many signals might be cut out. It is unlikely however that it could be brought down to the 1914 numbers, and certain that it would be more of a code and less of a list of abbreviations.

It must be pointed out that the F.A.T. 1914 list of abbreviations and its two successors have both been cancelled, and no longer exist officially. But beyond the question of the advisability or otherwise of the re-introduction of some such code, there is already sufficient grounds for a plea for a reconsideration of the situation as regards codes generally. For the artillery code cannot be used for sending information or observations from a ground O.P. to the battery, and there exists no other code for such communications. The simplest messages must

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therefore be sent in clear; probably the majority of B.C's are in favour of the introduction of some code or abbreviations for this purpose.

Conclusion. In forming an opinion on such a big question, the chief difficulty is to keep in view the widely differing factors affecting the case. The future of observed shooting, the development of means of communication, the degree of training of the soldier in the next war, the probable nature of that war. Amidst such considerations the fact that a good field battery in 1914 could do a creditable shoot at practice camp with double line semaphore at 600 yards, and long service signallers, has almost insignificant value as evidence.

The following suggestions are therefore offered as a basis for discussion and not as a proposed solution.

(i). In view of the difficulties of training signallers in any army other than a long service regular army, too much reliance should not be placed on a system which entails a quick rate of signalling, a complicated procedure or much memorisation of codes.

(ii) That though it will very rarely be possible to support *an attack* with observed fire, in all other cases observation of fire will continue to be of paramount importance.

(iii). In order that each observer (there cannot be more than a certain number on a given front except in special types of country) shall be able to put the several units of his group, brigade or linked batteries on to any target that appears, he should have at his command two ways of bringing observed fire to bear. One in which he reports the target, and perhaps its value in terms of ammunition (cf. the LL and GF targets), and sends observations of fire if possible. The second in which he personally controls and directs the fire of one battery, and sends corrections as opposed to observations.

(iv). That where the latter procedure is possible it shall be held to be far preferable, and that it shall therefore be the subject of constant practice.

(v). The telephone (or voice control) is the most satisfactory means of sending information, observations or corrections. But it must not be relied on as the only method, and as it is so much simpler than the others, these require more practice.

(vi). Where continuous observation of the fire of a battery, *or* continuous communication between the observer and the battery, is impossible, the observer should be allowed to use the aeroplane to artillery code and method of reporting observations. And in order that the value of this code may be increased, a limited number of signals should be added to it with the proviso that they shall not be used by, and need not therefore be memorised by the R.A.F. observers.

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(vii). That the artillery code should be amended to take out all signals not required for shooting a battery, purely and solely; and that such re-arrangement and amendment be made as is entailed by current fire discipline. After which the code shall be used for all shooting messages where voice control or a speaking telephone is impossible.

(viii). That every encouragement should be given to induce the authors of new methods or suggestions to produce them in order that they shall be given a fair trial.

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GUNS WITH INFANTRY.

BY BRIG.-GENL. W. EVANS, C.M.G., D.S.O.

Capt. H. S. Thuillier, in his article on "The Organisation and Employment of Pack Artillery" in the August Journal concludes as follows :—"The experiences of the war, read in the light of probable future requirements show the difficulty wheeled artillery have in giving constant and close support to the infantry. The possession of a powerful weapon such as the 3·7″ howitzer should be fully exploited so as to minimise these difficulties."

Major W. E. Burr, Field Artillery, U.S. Army in his essay "Some Aspects of American Field Artillery" (awarded second prize, Field Artillery Journal Prize Essay Competition 1922, and published in that journal May—June 1922) writes :—

. . . . "Coming to the pack artillery we find the progress exceedingly satisfactory. The seventy-five millimetre pack howitzer, model of 1920, appears to fill the requirements of the calibre board far better than the new models in the larger calibres. If the war had lasted a few months longer, the value of pack artillery as an adjunct to the divisional brigade would have been well tested."

The conditions of a modern battle require more changes of position by at any rate a proportion of the artillery. The range of the modern gun makes this appear waste of power, but as direct observation from gun positions is practically dead, the problem of directing fire quickly to suit the needs of the infantry makes it essential that some guns should be sufficiently close to the front line, for a runner or flag signaller to put their commander quickly onto any target required. The question arises what nature of artillery should be made use of for the close support of Infantry—how should it be armed—should it be horsed, &c., &c.

In this connection it is interesting to read an article by Lt.-Col. Alléhaut[1] in the French *Revue Militaire Générale* of June 1922 entitled "Support of infantry by the gun". He commences by dwelling on the necessity for neutralisation or destruction of the machine guns of the defence.

Next he says :—The tendency seems to be for artillery ranges to become longer and longer and their zones to become wider, thus giving the great advantage of being able to concentrate the fire of batteries

[1] Lieut.-Col. Alléhaut. L'appui de l'infanterie par le canon.

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in action on a wide front and so to obtain the effect of *massed action*. Also now that guns can be fired with accuracy without registration, it is possible to open fire on a given area with absolute suddenness thus gaining the effect of *surprise*.

So the Command can now make use of these factors of massed action and surprise.

No longer are long artillery preparations necessary, which put the enemy on their guard, but short violent concentrations can be directed immediately before an attack, which take him by surprise, and deprive him of the use of his weapons at the moment when the attack is launched.

In the course of the battle, too, *the theory* is that the command can make use of the power and flexibility of its artillery to help the progress of the infantry.

This appears to be a very good proposition. When, however, one contrasts these theories with the realities of the battlefield one finds that if they are applied to all the phases of the battle, the result arrived at is that just at the very most critical phase of the fight, the infantry is deprived of *any useful support* from the artillery.

In the battle to hit hard and unexpectedly is of no use unless the blows are delivered *when* and *where* the infantry require them.

Now the question arises "who directs the battle?".

Col. Alléhaut takes as an example to bring out this query the action by a division against an organised position. He says :—

(1) The preliminary arrangements, and centralisation of the artillery command is entirely satisfactory to the infantry and is so up to Zero hour. What then?

(2) The assault is launched and action varies from moment to moment. How can artillery adapt its fire to meet the constantly changing situation.
Experience shows that however carefully the lifts, pace of the infantry, etc. are worked out, yet, sooner or later the general action resolves itself into a series of partial combats.

And now, who directs the battle.

I do no more than touch lightly on the remainder of the article. Col. Alléhaut describes how French and Germans came to the conclusion that artillery must be allotted to and placed under the orders of Infantry Brigade commanders . The *engin d'accompagniment*, to deal with machine gun nests, is acknowledged by all to be a necessary adjunct to battalions, but must be added to in battle by the direct support artillery, which must be divorced from the divisional artillery, and placed under the infantry commander, who can do what he likes with it. Even if the infantry commander is incompetent, the artillery group commander, who should be in the same command post, can prevent his misusing it.

Colonel Alléhaut criticises the use of the 75 mm. gun by the French as direct support artillery, and considers it should be supple-

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mented by howitzers to engage targets that flat trajectory guns cannot deal with.

Such are the main points of Colonel Alléhaut's article.

One must not let one's experience of trench warfare lead one to suppose that wheeled artillery *cannot* closely support infantry in future wars, but at the same time it would appear worth while to think out a light howitzer equipment, movable on wheels or by pack, its ammunition supply, its training in quick changes of position &c., so as to supplement the divisional artillery with an *artillery of direct support.*

The first effort I saw made in the direction of artillery from the front without any reference to the Division was in the Divisional Defence Scheme from March 1916—July 1916 at Ypres when my G.O.C. made me keep several guns in well concealed forward positions —the idea being that in the event of our front line being taken these guns were close up to the infantry and could act quickly on information gained from them.

Everyone will agree with Col. Alléhaut that in the course of a battle although the rolling barrage, and the concentrations of heavy guns pursued the even tenour of their way, not so the assaulting infantry, and that the Division was often quite unable to direct artillery fire *when* and *where* the infantryman wanted it.

Nests of machine guns can be dealt with by our tank, or the French *engin d'accompagniment*, but these must be supplemented by some guns which can act independently of the Division.

The more one studies this subject the more convinced one is that Infantry officers of all ranks should be much more conversant with the use of field artillery, and that having the knowledge to use it, they should have under their direct command some form of Artillery of direct support.

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SECONDED OFFICERS IN THE ROYAL AIR FORCE.

(With special reference to War Office letter No. W.O./R.A.F./132 (M.S.I.), dated 7th June, 1922, a copy of which was published in the July number of the R.A. Regimental News.)

BY LIEUT. D. W. CLARKE, R.F.A.

AT a time when the Army and the Navy are being reduced to the very lowest possible establishments, the Royal Air Force is just entering upon a new phase of its existence.

The fact is daily becoming more and more apparent that, as we reduce our sea and land forces, so must we rely still further upon our Air Defences to withstand the first blows of any attack aimed at this country.

It is said that offence is always the surest form of defence: and it should be remembered that whereas navies have first to negotiate miles of ocean at a comparatively slow speed, and armies have to be transported by rail and ship, before either can strike the first blow; yet huge formations of aircraft can operate from these shores within a few hours of the outbreak of war to bomb the enemy's towns and to destroy his communications.

In the highly critical first few days of a European War it will therefore be the rôle of the R.A.F. to hamper the enemy by offensive operations, in order to allow time for the small peace-time nucleus of the Army and Navy to expand to its full war strength; and for this reason it is essential that a proportionate increase in the R.A.F. must be made to counterbalance every reduction in the senior services, if the defence of this country is not to suffer.

This is the process which is taking place to-day; and thus we find the R.A.F. appealing for more officers at a time when the army and the navy are discarding them by the hundred.

We are informed that the Air Ministry require an average of 300 officers seconded from the Army, in addition to those commissioned from other sources; and according to the letter quoted at the heading of this article, this number is still 100 short of requirements. The period for which officers are to be seconded is four years, and the inducements offered are a congenial life with good pay and plenty of prospects of promotion.

To the officer between the ages of 22 and 28, whose chances of promotion in the army seem rather distant and whose position at the best of times may be somewhat insecure, the prospect of four years' service in the R.A.F. should prove a very attractive proposition; and

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there may be many who are considering this step, but who hesitate because they do not know enough about the life which they are contemplating.

It is to them especially that this article is addressed, in the hope that these remarks from a Gunner officer who spent two years in the R.F.C. and R.A.F. may help to give them a clearer idea of flying, and of life in the Air Force generally.

I do not propose to dwell upon the professional side of the question, for the official publications are always the best guide. It is to the purely personal side, upon which it is difficult to obtain much information from official sources, that I shall therefore confine my remarks.

First I would recommend all who can to attend one of the lectures which the Air Ministry are arranging in every Command, where they will hear the scheme for seconding officers very fully explained.

The first consideration of a prospective candidate for the R.A.F. will probably be his suitability for flying; and there are many reasons why people imagine quite wrongly that they will never be able to fly.

I will therefore preface my remarks by the statement that anybody can reasonably be expected to become a pilot, provided always that he is fit as regards age and health. A man has no more reason for imagining that he will never be able to fly, than he has for believing that he will never be able to ride; and the percentage who could never be taught is probably about equal in both cases.

In this connection it is interesting to note that riding is the nearest approach to flying that we know—driving a motor car for instance is a very different operation—and a good horseman will almost invariably make a good pilot.

An instructor will be able to satisfy himself after a very few hours in the air as to his pupil's chances of becoming a good pilot, and the rare exception who will never be able to fly can rest assured that he will be given no opportunity whatever of breaking either himself or his machine.

I know that a number of people, from their recollection of war-time flying, still picture life in the R.A.F. as one long series of accidents; and imagine that no one can become a pilot until he has survived the proverbial three crashes. A short discussion on crashes might therefore serve to illustrate how vastly different are the conditions of the present day.

From my experiences as a member of a number of Boards which investigated the causes of crashes at aerodromes in England during the earlier part of 1919, I would feel inclined to attribute accidents during that period to the following causes :—

Error of Pilot—Probobly 75%.
Failure of Engine—About 10%.
Failure of material—5%.
Accidents caused by flying during bad weather (chiefly fog)—5%.
Other causes—5%.

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These figures are not based upon any accurate statistics, being simply a rough estimate entirely from memory; but it these causes are examined separately it will be seen that they are all practically non-existent at the present day.

Errors on the part of the pilot fall distinctly into two divisions; those caused by sheer inexperience, and those caused by recklessness and carelessness.

To-day there is ample time for training; pilots no longer have to be turned out at the rate of hundreds a month to replace casualties in the field, and under the present conditions no crash should ever occur through the inexperience of the pilot. Aeroplanes are fragile and expensive machines, crashes cause a good deal of trouble and are very bad for the morale, and such precautions are now taken to prevent accidents that a pupil can be absolutely certain that he will never be called upon to take a machine into the air unless he is perfectly capable of bringing it down safely.

During the war these extensive precautions were not possible, with the result that a very large percentage of accidents at training centres were directly due to pupils being sent up by themselves in machines on which they had not had sufficient training.

Recklessness in the air I think we may attribute very largely to the War and to the extreme youth of the average pilot of that period, and it is not a contingency which is likely to arise much in peace-time. The pilot who goes in for dangerous and careless flying to-day has only himself to blame if he crashes in consequence, and will have to answer before a court of inquiry for the loss of a valuable machine.

I think that most of us have learnt by now that unnecessary recklessness cuts no ice in war, and this applies very strongly to the flying services in peace as well. It may come as a surprise to many to learn that dangerous flying is a court-martial offence in the R.A.F.; and recklessness is, very rightly, strongly discouraged. It is the direct cause of many accidents, and reflects upon the squadron in the loss of men and machines, with the consequent imposition of a greater strain on the remainder of the unit who still have to carry out the work of the absent pilot.

Another frequent cause of crashes during the War was the failure of material, and particularly of engines, necessitating hasty forced landings on the most unsuitable ground: but here again the improved conditions of peace should prevent future accidents from this cause.

When one considers the conditions under which machines and engines worked during the War, it is surprising that failures of material were not of far more frequent occurrence. Turned out in their thousands by gramophone and sewing-machine factories, and then sent straight to France to be flown for hours daily without even the chance of a proper overhaul, or to the East where 'planes stood out in the open day and night in alternate streaming rain or blistering heat, it is not to be wondered at that engines sometimes "conked out" or machines collapsed under the enormous strain.

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To-day it is a very different matter; for aeroplanes are manufactured at established aircraft factories where all the results of scientific research and exhaustive tests combine to reduce that element of danger to the very lowest degree, and the modern pilot may rest assured that his machine will never let him down.

A visit to the annual R.A.F. Pageant at Hendon will soon convince the spectator of the superb confidence which the modern pilot has in his engine: while a standing example of the reliability of aeroplanes to-day may be seen in the number of daily trans-continental journeys with scarcely a single instance of engine failure. To quote one specific case: the U.S.A. Government Air Mail Service flying at midnight completed a year's daily service between New York and San Francisco without a single fatal accident—surely a very rigorous test of the safety of modern aviation!

I have frequently heard people say that they "haven't the nerve for flying"; and they seem to imagine that a devil-may-care reckless temperament is essential to a good pilot. This is quite a wrong impression: and it is the phlegmatic, stoical nature of the man who never loses his head and who is not easily upset, which really counts in flying.

Nerves in the medical sense of the word naturally do play a prominent part in the fitness of a pilot; but it is rare to find anybody who actually feels nervous in the air. If asked what was the predominant sensation when flying, the majority of pilots would probably say boredom; for there is an extraordinary feeling of security in an aeroplane in flight. The sensations of an airman in a machine travel ing at over a hundred miles an hour are really amazingly tame, with no hedges or trees to dash past, there is nothing to judge speed by in the air, so much so that many passengers on their first flight imagine quite naturally that the aeroplane is not moving at all.

Another reason which deters many people from taking up flying is an impression that they will suffer from sickness in the air.

Cases of genuine "air-sickness", which occur on any flight however straight and calm, are very rare indeed; and a test flight, which the R.A.F. are always ready to arrange for a prospective candidate, will be quite sufficient to convince one as to the likelihood of suffering from this complaint. A squadron-leader of very vast experience recently told me that he had never come across a single case of air-sickness in the whole of his flying career.

Although the majority of pilots are usually sick the first two or three times they are "stunted", this is quite distinct from "air-sickness" and is a very natural effect on anyone who is not accustomed to being turned rapidly upside down or round and round. It is only very excessive "stunting" which causes this sickness, and even then it occurs only on the first two or three flights.

Vertigo is another malady which never occurs in an aeroplane, and it is quite wrong to imagine that anyone who feels dizzy on the

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top of a high building will experience the same trouble in the air, for the two sensations are completely different.

There is just one final point about flying which may be a comfort to many. A knowledge of, or even an aptitude for mechanics is not essential to a prospective airman, and a pupil will learn all that he will want to know on this subject during his first year's training in the R.A.F. I make this statement on good authority, and would add that the present writer joined the R.F.C. with an amazing ignorance of engines and their ways, and really found it by no means a serious disadvantage.

I hope in the foregoing remarks to have conveyed some idea of the actual flying itself, and to have dispelled a few of the doubts which exist as to the requirements of a prospective candidate for the R.A.F. The remainder of this article I shall therefore confine to a description of the general conditions of life in the Air Force.

Training will occupy the best part of a seconded officer's first year in the R.A.F., and an outline of the general routine of training will perhaps serve to give him some insight into this very critical part of his flying career.

The pupil's first introduction to the air will be in a training machine fitted with a dual control—probably an Avro. Both seats in the machine are fitted with a complete set of controls, and either pilot can fly the aeroplane independently of the other; but at the same time the instructor can exercise control over the movements of the pupil, and can be ready to correct any errors on his part.

Generally speaking the controls of an aeroplane are of three types: the engine controls, usually in the form of a Bowden wire similar to that on the handlebars of a motor bicycle, the control column or "joy-stick", and the rudder-bar.

The "joy-stick" performs two separate functions: it raises the nose of the machine to ascend, or lowers it to descend, by means of a forward or a backward movement; while on being moved to one side it dips one wing tip and raises the other in order to "bank" the machine for turning.

The rudder-bar, which is moved by the feet as a rule, controls the direction of the aeroplane with an action similar to that of a rudder on a boat.

Most evolutions in the air are performed by a combined motion of the hands and the feet on the "stick" and the rudder-bar: all movements are gradual and smooth, and in no case is the control ever jerked.

At first the instructor will do most of the flying, the pupil merely resting his hands lightly on the controls in order to "get the feel" of the various movements. Later, as he gradually gains confidence, so the instructor bit by bit reduces his control of the machine until the pupil is flying it entirely by himself. The instructor then remains in the machine simply to give the pupil a feeling of security, and to correct any errors on his part.

Straight flying, with ascending and descending, forms the first

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part of the instruction; then come gentle turns, followed by practice at "taking off": afterwards the pupil learns the more difficult turns, and finally "landings".

When once a pupil has plenty of confidence, can take a machine off, fly once or twice round the aerodrome, and do a good landing, he is ready to be "launched"; and from then onwards the really interesting part of his training will begin.

"Launching" is quite the most memorable moment in one's flying career.

One clear morning when there is no wind, and after a couple of circuits of the aerodrome have already been satisfactorily negotiated, the instructor climbs out of his seat, leaving the engine still "ticking over", and stands on the ground beside the pupil. . . .

"Feel all right? . . . . Well, off you go!"

Out roars the engine, up goes the tail, a few bumps over the ground, and the pupil is up in the air by himself for the first time. Launched!

The sensations of those first few moments in the air alone are not easily forgotten; for there is a wonderful ecstasy about flying, and as a tonic it takes a good deal of beating. Many a pilot has gone up into the air with a head like lead and a tongue like leather, only to alight an hour later with a ravenous appetite for breakfast and a general feeling of content with the world!

Once he has been launched, a pupil will vary his flights on his own by further trips with his instructor, to learn "stunting" and to perfect his earlier training.

Later on he will try his hand at a cross-country flight to a neighbouring aerodrome and back: then come formation flights with the rest of the Squadron, when he will learn something about drill in the air; followed by cloud flying and navigation tests.

Aerial fighting, machine-gun practice from the air on ground targets, or aerial gunnery with a camera-gun which takes a photograph every time the trigger is pressed, will all add to the interest of his training; and at this point the pupil will probably start work on a service machine, and gradually will do less work on the training machine as time goes on.

If he is to be a scout pilot he will have to go through another "launching", for there can be no dual control practice on a single seater 'plane; and to be launched in a completely strange machine is in itself quite an experience.

In the range of ground subjects learnt during the training period are included engines and mechanics, theory of flight and rigging of aeroplanes, machine-gun and wireless work; together with navigation, map-reading etc., in addition to some of the normal military subjects such as squad drill, physical training, and similar work.

The majority of Gunner officers who go to the R.A.F. will probably specialise in artillery co-operation work; and they will find that the Air Ministry have reduced training in this subject to a fine art. So in-

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genious is some of the apparatus used in the training of observation of gun-fire from the air, that it would be impossible to approach any nearer to the real thing without actually working from a machine in flight.

The Air Force training is extremely interesting and novel, and they seem to have managed to dispense with most of that monotony which we usually associate with the word "training".

As regards recreation and life in general, the seconded officer will find the R.A.F. very little different from the Army. Cricket, football, hockey, golf, etc. are all keenly followed: the polo player will find himself well provided for by the R.A.F. Polo Club, which was formed very shortly after the Armistice; and the hunting man can take his pick of half a dozen aerodromes in the middle of the best hunting country.

Mounted sport in all its branches is looked upon very favourably by the authorities, and no officer need feel afraid that he will have to give up his horses on appointment to the R.A.F.

To those who seek active service and the consequent chances of promotion, the Air Force in Iraq, Somaliland, or the North-West Frontier of India will always offer ample opportunities.

Promotion in the R.A.F. being entirely by selection, irrespective of seniority, the seconded officer should find plenty of chances in this direction.

Any officer, therefore, who looks for a secure position free from the ravages of the "Axe", combined with good pay, good prospects of promotion, and a life which is healthy, interesting, and congenial, would be well advised to consider very seriously the possibilities offered by being seconded to the Royal Air Force.

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SUGGESTIONS FOR THE MARCHING OF TRACTOR ARTILLERY.

BY MAJOR G. RALPH MEYER, C.A.C.

Reprint from Journal of the United States Artillery.—March, 1922.

THE writer was fortunate enough to be in command of the 2nd Battalion (155 G.P.F.) of the 51st Artillery (Tractor) during the movement overland from Camp Jackson, S.C., to Camp Eustis, Va., during September and October 1921. The movement covered a period of 40 days and the distance travelled was approximately 600 miles.

Because of the reorganization of the regiment and the attendant confusion and calls upon the time of the battery officers in settling their property accounts, all the necessary preparatory work could not be done. An attempt however was made to overhaul all tractors and put them in the best possible condition.

It is believed that the experience gained as a result of this movement should be made a matter of record in order that officers who in the future may be confronted with similar problems may have something to work on and not be compelled to "go it blind". The points mentioned in this article are not the only ones which need attention. They are merely those which forced themselves upon us during the trip. The ideal condition, of course, would be to have only tractors which had been completely overhauled by a thoroughly capable repair section; tractor drivers who were experts and a group of experienced repair men available to make the many repairs which are necessary on the road. This is the ideal condition and like most ideal conditions it will not be a practical possibility.

The points to be remembered have been grouped under two heads: Preparation, and On the road. Each of these have been further subdivided into: Tractor, and Gun. It is assumed that some enlisted man in the battery is competent to direct the work on the tractor.

PREPARATION.

A. Tractors.

Complete overhaul of the tractor with special attention to the following:

1. Motor.
   - Clean carburetor.
   - See that the clamp screw will hold carburetor adjusting needle in place.

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Clean vacuum tank.

See that breaker points in circuit breaker are clean and open well.

Have all valve springs in good condition.

Have rocker arm working freely and oil hole felts clean and free from dust. See that bushings in rocker arms are in good condition.

Have air intake to carburetor connected to air cleaner and have the latter clean.

Have cylinder head gaskets in good condition. Use copper faced asbestos gaskets.

See that all crank and connecting rod bearings are in good condition and all cotter pins in place.

Clean all gas lines and see that all couplings are tight. Clean outside of motor.

2. Lubrication.

Overhaul track oiling system and clean thoroughly.

Clean crank case and oil-pump strainer.

See that grease passages are clear in truck roller bearings, in drive sprocket and blank sprocket shafts. All grease cups to be in place and grease passages clear. Particular attention must be paid to this on the steering clutch shifter ring, and the master clutch shifting fork. It will often be found that grease has hardened in the grease passages and this must be picked out and cleaned so that the grease can reach the bearing surfaces.

See that there are no oil leaks around the external drive gear housing.

See that oil gauge functions.

Lift top transmission and clean lower case. Clean the oil strainer there.

3. Cooling system.

See that radiator brace is intact.

Examine radiator foot studs. These have a tendency to break off near the tractor frame and leave the radiator loose on the frame.

(It is believed that the change in radiator braces now being made by the Ordnance Dept., will obviate much of this trouble. The change consists in the installation of a heavy brace on each side of the radiator running from near the top of the radiator to a point well back on the tractor frame.)

Have fan and pump belts, if "V" type, treated with neatsfoot oil if new. If no neatsfoot oil is available ordinary engine oil will add materially to the life of the belt.

Look for leaks in cooling system and repair them.

See that bolts on pump shaft stuffing box follower are tight.

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4. Track Assembly.

Take out thrust rod and have threads cleaned. Clean hole into which threaded part extends. Pack grease in this hole around threaded portion of the rod and put piece of waste in to cover the opening. This will keep the threads clean and lubricated so that track can be adjusted.

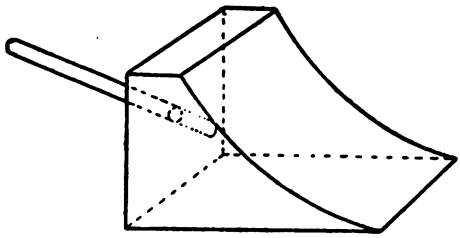
Examine all track roller supports and replace any that are cracked.

Tighten all nuts holding supports to frame.

Have track adjusted.

5. Transmission.

While upper transmission is raised to clean lower part, test the bearings of the intermediate shaft and see that the intermediate shaft nut is tight and locked. Take the steering clutch shifting ring coverplate off and examine the hexagonal nut which secures the thrust bearing to the pressure ring. This nut is kept from turning by a set screw which sometimes shears off. Failure of grease to reach this thrust bearing will cause the nut to break or the threads to strip, resulting in complete loss of that steering clutch.



Chock for right wheel.

FIG. 1.

B. Gun.

Get wheels with tires in good condition.

Clean hub liners and axles with gasoline. Be careful that there are no particles of loose metal in interior of hub.

Grease with heavy axle grease and have closed can in which grease can be carried on the road.

Adjust the brakes carefully.

If caterpillar bands are to be carried on the guns use new carriers if available. If not reinforce old ones by nailing 3 × 8's to them. The lifting bar should be carried at the limber end of the carriers to allow them to be kept as far from the ground as possible at the gun axle end.

Have several chocks with handles attached for use in chocking when going up steep grades. Have some for left wheel and

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some for right. Carry timber blocks 6 × 6, 3 × 12 and 10 × 10, all 18″ to 2′ long. Also two gun jacks per battery.

On each gun have 150 ft. of 5″ rope for use in crossing bridges where tractor must be uncoupled.

For use in steering gun along way planks in crossing bridges when tractor is uncoupled, devise an extension for the draw bar. If a line is made fast to the end of this with an end to each side so that four men may take hold on either side, the gun may be easily steered. Without some such appliance it is extremely difficult and very dangerous to move the draw bar. It requires the combined efforts of four men to move it and they are so close to the limber wheels that a slip may cause a serious accident. The drawbar should be pinned in the horizontal position. The sketch herewith is a suggestion for a drawbar extension. It can undoubtedly be improved upon.

In many cases it will be possible to take the guns across bridges by hand. With a slight down grade on the bridge 15 men can pull the gun across. One man should remain on the brakes.

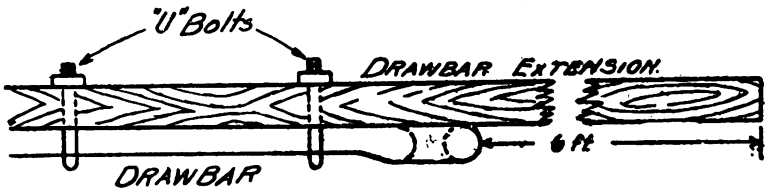

FIG. 2.

ON THE ROAD.

A. Tractor.

Too much cannot be said about keeping the tractor clean throughout. If possible the tractors should be gassed every evening before dark. During the summer months this can be done after the day's run, assuming the run completed by 5.30 p.m. As the days get shorter this becomes impracticable as there is constant danger when gassing after dark when lanterns are being used and side lights are lighted. A halt at 4.00 p.m. for this purpose will permit an early start next morning.

The hourly stop should be utilized by the tractor drivers and assistants in cleaning the tractors, turning up grease cups and inspecting for loose nuts and connections. Battery officers during these halts should inspect the tractors paying particular attention to the same things mentioned above under preparation. If the tractor is kept clean it will greatly assist in making these inspections of value. This systematic inspection will prevent many breakdawns by locating weak

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spots before the break occurs. Remember that many things can happen to a tractor in a 45 minute run. A track roller support, for example, can very easily loosen up in that period and when once loosened up it may break at any time.

The length of the runs as well as the stops between will depend much upon the weather. During hot weather the stops must be more frequent and for a longer time. It was found possible at times on this trip to run for 1½ hours at a time and then stop for 15 to 20 minutes. This could be done on cool days or for night running. On hot days however it was necessary to stop for from 10 to 20 minutes every hour. The guiding factor is overheating of the motors.

After stopping for the night the tractor should be thoroughly cleaned, the outside of the motor cleaned, oil put in the crankcase, all grease cups filled and the grease gun used where necessary on bearings. At all times grease should be carried in cans with tight fitting tops to exclude all dust and dirt.

The hand book of the 10-ton tractor prescribes that the crankcase be cleaned with kerosene every two weeks and fresh oil put in. At this time the bearings in the crankcase should also be inspected. After washing the crankcase with kerosene be sure that all kerosene is taken out of the upper crankcase.

The successful operation of the tractors over the road for any extended period is largely dependent upon the "stick-to-it-iveness" of the drivers, the ability of the tractor mechanics to make road repairs, and the ability and desire of all officers to keep after the care and maintenance at all times. There are innumerable accidents and breakdowns which can and will occur, and it will be necessary to work very long hours at times on any extended move. Experience is the only teacher from whom it is possible to learn the many expedients which can be used to save long delays, and the only way to prepare in order to properly benefit from that experience is to know the tractor and to know it perfectly.

Towing the G. P. F., the tractor can negotiate almost any kind of road. In very wet places or in very bad roads where the gun bogs down in deep sand or mud it may be necessary to put two tractors on the gun. However, if the caterpillar bands are put on the gun wheels in such ground one tractor should pull it. Some difficulty was experienced in going up steep grades on concrete or Belgian block roads. The surface of such roads is so smooth that the tractor cannot take hold. Such grades should be avoided whenever possible.

In crossing bridges it is always well to have the tractor run slowly in first speed. Even though the bridge is strong enough, this reduction of speed greatly reduces the racking effect on the bridge.

In running over narrow roads where two tractors could not pass it is advisable to send a spare tractor ahead so that it may be used to pull out any which may get stuck. In crossing railroad tracks where there is a steep grade up to the track it is well to have a spare tractor at hand to assist if the tractor with the gun is stalled. Have flagmen out when-

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ever crossing a railroad track. One thing which must be impressed upon all tractor drivers is the necessity for shifting gears at times. The tendency of the average American driving any motor vehicle up a grade is to "make it in high" if possible. The tractor driver exhibits the same characteristic. In his case it is more important to avoid changing gears on the grade, for he so often kills his motor doing it. The same is true in shifting from 1st to 2nd or 3rd after crossing a bridge. Have him get his gun well clear of the bridge before he tries to shift. If he kills his motor then he will not hold up everything behind him. In going up grades the best rule to follow is : if in doubt as to ability to make it in a certain speed, shift to the next lower speed before starting up the grade.

Never allow the tractor drivers to make any changes on the carburetor or magneto. This should be done by the tractor mechanic or battery officers only. The tractor mechanic should be moving along the line constantly while the convoy is moving and should be on hand to make all adjustments and repairs.

B. Gun.

Occasionally, while the gun is moving, the gun commander should feel the hubs of all the wheels to see if they are running warm. If a wheel runs hot it may become necessary to take it off and clean it with gasoline and put in fresh grease. The grease at all times should be kept in tightly closed cans. A very little grit in the grease will make a wheel run hot and will score the hub liner badly.

For any long move, the spare wheel furnished the battery must be carried. Running on high crowned roads wears the rubber tires badly and if the rubber is old or dead will pull the tire off the rim.

Before starting on the trip it was desired to know the actual weight of the tractor, gun, howitzer, etc. A large scale was available and the weights were found to be as follows :—

10 Ton Tractor	21500 lbs.
Wt. on limber wheels of G.P.F. travelling position	13100 lbs.
Wt. on Gun axle	19000 lbs.
Total wt. of G. P. F.	31500 lbs.
8″ Howitzer limber and gun	23500 lbs.
Platform	9000 lbs.

The weights given for the G. P. F. are for the gun with all equipment ready for the road—spades, caterpillar bands, lifting bar, blocking and rope.

Professional Note.—MOTORIZING ENGLISH FIELD ARTILLERY.

From United Service Gazette, December 29, 1921.

The War Office have given instructions for the four batteries of the 9th Brigade, Royal Field Artillery, now stationed at Deepcut, in the Aldershot Command, to be "mechanicalised" for the purpose of

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practical experiments. All the horses of the Brigade, except those of the officers, have been withdrawn and sent to the Remount Department. The personnel of the Brigade are now being trained to drive and to repair the kind of tractors to be used. It is understood that a tractor fitted with caterpillar tracks has been officially recommended for the trials, which are to take place shortly in the Aldershot Command. It is urged in favour of mechanical draught that it is economical in man power since the personnel of a battery might be reduced to approximately one half, when compared with one relying on horse draught.

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A FIELD ARTILLERY GROUP IN THE GENERAL ADVANCE.

BY COLONEL W. H. F. WEBER, C.M.G., D.S.O.

PREFACE.

Between November 1919 and March 1920, there was published in the R.A. Journal under the author's name, in 5 Parts, an article recording with comments the doings of a Field Artillery Group, whose nucleus was the 2nd Brigade, R.F.A., during the great German offensive of 1918. It was entitled "A Tactical Study of the Field Artillery Group in Retreat." It was republished complete, with little additional comment, in 1921, by the American Field Artillery Journal.

The preface to the above-mentioned article explained the author's reasons for writing it, which apply to this paper equally as well as to its predecessor. In these days of changes of armament, the Press, military and civilian alike, frightens us with prognostications as to the next war; horrors are thrust in our face by the protagonists of the aeroplane, the tank, and chemical warfare in turn; the submarine terror seems quite innocuous in comparison. The author has no intention to underrate the possibilities of development in these branches of warfare, but would rather leave them to more ambitious prophets. His object is, by presenting in some detail a record of facts, to provide a framework on which to consider the practical effects on field artillery in battle of these developments.

In the May—June, 1922, numbers of the R.A. Journal, appeared an exceedingly interesting article by Lieut.-Colonel C. N. F. Broad, D.S.O., R.F.A., entitled "The development of Artillery Tactics 1914-18", which presents the tactical (and indeed strategical) influence of artillery in its true light. One only wishes that the arguments and tendencies set forth therein could have been as clearly brought home to regimental leaders at that time. Orders and instructions would surely have been obeyed with more intelligence? But of course the quiet of to-day is so different to the conflict of thought, and the hurry and rush, which obtains on the theatre of operations.

Lieut.-Colonel Broad outlines developments still impending at the end of 1918, as follows :—

(a) Improvements in actual battle co-operation by the Royal Air Force.
(b) The introduction of large masses of tanks.
(c) The improvements in all forms of communications.

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(d) The increase in mobility owing to cross-country traction.

Lieut.-Colonel Broad was probably thinking chiefly of Heavy Artillery, but the last of these developments, at present being applied to the R.F.A. by the substitution of the mechanical tractor for our well-beloved draught horses, is likely to create a new mental attitude in the personnel. Will it materially alter field artillery tactics?

Once more the author wishes to apologise for any criticism which may be thought to apply to other formations or individuals. He declares again that the only intentional criticism is directed against "The Group Commander." The 6th Divisional Artillery was, in truth, a happy family, for its Chief was one of those who make happy families —which was none the less so because he taught, in a very kindly manner, that obedience is a soldier's first duty; he practised what he preached. For our infantry we entertained the most profound respect and affection.

Birkin House, Dorchester. W.F.W.
Aug. 26th, 1922.

PRELIMINARY.

The Brigade Commander (2nd Bde., R.F.A., 21st, 42nd, 53rd and 87th (How.) Batteries), arrived back in the Ypres Area from Shoeburyness in the first week of September, to find 6th Divisional Artillery withdrawn from the Line preparatory to moving into the Somme district, and himself acting C.R.A. The elaborate arrangements to meet the expected attack by Prince Rupprecht of Bavaria had, fortunately, never been tested. On the contrary the enemy was retiring and Mount Kemmel fell into our hands once more.

NOTE.—The Author has since heard first-hand from German sources, how very unpleasant we had made his Hazebrouck salient for the enemy during the months of May, June, July and August.

The Fourth Army had attacked on August 8th and achieved a brilliant success. The French were fighting steadily on its right. The Third Army had joined in the attack (on the Ancre) on August 21st, and the First Army had broken the Queant—Drocourt Line E. of Arras on August 26th. On the Somme we had almost regained the ground lost during the German offensive; the First Army was an important step in front of its 1917 line.

The author would summarise as follows the psychological attitude of troops reaching the Somme battlefield at this time. The Somme held bitter memories for 6th Division, but the Fourth Army seemed

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"on the win". British troops had had a breathing space in which to recover from the severe blow dealt them in the Spring. It was probably possible after all to drive the enemy out of France and the war might really be ended before so very long. The Americans were seriously engaged and were present in France in great force, in spite of submarines. Things were looking better in other theatres of operations. Recent successes on the Western Front seemed to offer more than previous 'victories.' The third battle of Ypres (or Passchendaele) followed by the German offensive, had entirely altered the constitution of units, but some experience had been gained with the new personnel. We had not forgotten our offensive lessons of 1916-1917 and we had learned something during the year of defence; but always of the trench warfare and limited objective type of fighting. There might be open warfare before us, but of that we had no experience; such personnel left as had been trained in open warfare had forgotten it. Put into other words, we expected ample time to prepare for action, expected our food and ammunition to reach us according to plan, looked for reasonable comfort, and should fight by the map with the help of a barrage scheme which freed regimental officers of need for decisive independent action. One cannot have things both ways; we had grown used to "control cake".

On September 6th, the Bde. Commander summarised lessons gathered from the troops already in battle as follows :—

(i) Not many casualties, but hard work, and short sleep.
(ii) Forward reconnaissance as well as observation, and liaison, to arrange for.
(iii) Necessity of 2/3rds. artillery being always ready to lay down a protective or creeping barrage; not more than 1/3rd. to be on the move.
(iv) Possibility of advanced sections with battalion headquarters.
(v) Shooting oneself in from observation, rather than by use of map.
(vi) Infantry jumping-off places conform to artillery barrage possibilities; direct attack on obstacles in preference to turning movements.

It was just possible to hold[1] 4 battery exercises and one brigade exercise, with full staffs, and one sub-section present per battery, rest represented by their Numbers One, to inculcate the forgotten principles of open warfare, before the 2nd Bde. moved to battle on Sept. 13th.

* * * *

We heard, from those we relieved, of pursuit and infantry guns; very little of the kind was to come our way, at any rate at first. Theirs had been the long drive; we were to make an approach shot; our neighbours were to hole out across the Canal de St. Quentin at Bellenglise.

[1] We also held our long-promised, but time after time deferred, sports; the luck was against us, for the weather was wet, but refreshments only dry.

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PART I. (See Map No. 1.)

"THE APPROACH TO A FORTRESS."

CHAPTER I. Sept. 13/17.

One must consider the Hindenburg line as the wall of a fortress, plans for the defence of which had long been prepared. From the point of view of the artillery supporting the attack, then, we were in for none too easy a task.

The outline of events during this period is given in pages 122—125 of Major-General Sir A. A. Montgomery's "Story of the Fourth Army" and in slightly more detail on p. 59 of Major-General T. O. Marden's "Short History of 6th Division." The general trend of these events will only be briefly mentioned in this paper.

On the 13th September, 2nd Brigade, R.F.A. marched out of Corbie, spending the night 13/14 West of the Somme; we had opportunity there to witness determined, though to themselves disastrous, efforts of enemy airmen to destroy the rough bridge at St. Christ—Briost. It was on this night that 6th Division relieved 32nd Division (IX Corps) on the Holnon Wood front.

On the night of 14th September the Brigade was in action in a supporting position S. of Villeveque (Position No. 1.), ready to fire a long-range defensive barrage. 24th Brigade R.F.A., the other 6th Divisional Artillery unit, was in front and already engaged in some rather confused infantry operations along the Eastern edge of St. Quentin and Holnon Woods; the village of Holnon long remained a disputed point.

The 15th September was spent in reconnoitring the area X 4, R 34 and 35 (Position No. 2.), for emplacement in the coming battle of the Left Group (to consist of 3 brigades), and in reconnaissance for passages through the woods; the enemy artillery made this duty unpleasant, especially within the confines of the wood. The defensive barrage prepared for the night was along the line X 22 b 5/0—X 17 a—X 11 c—X 4 d 3/5.

Instructions No. 1, issued by the Brigade Commander on 16th gave :—

(i) Approximate time and date of attack (dawn September 18th).

(ii) First and second objectives and a further objective for patrols.

(iii) Composition of left group—2nd Bde. R.F.A. (1.),[1] 14th Army Horse Artillery Bde., (consisting of four 18-pr. batteries) 161st Bde., R.F.A.

(iv) Allotment of tasks to Sub-groups, complicated by the necessity of advancing part of the Group whilst the barrage was in progress.

[1] Figures in brackets refer to comments at end of each chapter.

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(v) Map co-ordinates of tracks being prepared by R.E. through the woods.

(vi) Orders to prepare O.P's. at X 6 a 4/0 and R 35 d 5/8.

(vii) Allotment of liaison duties, as far as was possible at the moment.

(viii) Orders for dumping ammunition (18-prs. 300 r.p.g. 60% H.E. and 40% shrapnel with 50 r.p.g. smoke; 4·5″ Howitzers 250 r.p.g. fuze 106; echelons full).

(ix) Intentions reference wagon-lines (2.) and location of battle hdqrs. (3.), with orders as to synchronisation. (4.)

(x) And asked for "reconnaissance reports" from all 3 sub-groups on the areas into which they would have to advance during the battle, exact location of their intended battle headquarters, and information reference clearing the crests.

Special circumstances of the moment included the following :—

(a) An operation[1] had to be carried out on 17th to capture the Line of Departure,[2] which involved action by the French about Savy on our right. (5.)

(b) 2nd Brigade, R.F.A., could not occupy its battle position till night 17/18 because of its defensive responsibilities. 14th A.H.A. Bde. (still some distance away) was not to be allowed to use the roads forward on night 17/18 because of other traffic,—must therefore choose between spending 17th at some half-way halt, or occupying their battle position at once, with risk of giving it away. 161st Bde., R.F.A. was already engaged on or near its battle position.

(c) Ammunition supply was presenting difficulties and there was no smoke available.

Instruction No. 2, issued late on 16th, explained briefly 16th Infantry Brigade plan of attack, viz :—Capture of First Objective by 2/York & Lancaster Regiment (161st Bde., R.F.A. to find liaison); Capture of Second Objective by 1/Buffs on right (2nd Bde., R.F.A.) and 1/K.S.L.I. on left (14th A.H.A. Bde.).

Relying on known intentions, as would later be laid down in the barrage map, the Group plan was :—

2nd Bde.

(i) Centre portion of barrage up to protective line second objective.

(ii) Take over 161st Barrage (on protective line first objective) while latter were on the move.

(iii) Advance immediately after reaching the protective line second objective.

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[1] Progress in this preliminary operation was not wholly satisfactory, which caused much trouble on the 18th.

[2] Sometimes called "Jumping-off Place" or, again, "Starting Line."

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14th A.H.A. Bde.

(i) Left portion of barrage all through.
(ii) Be prepared to advance sections to support further objective of patrols.

161st Bde., R.F.A.

(i) Right portion of barrage up to First Objective.
(ii) Advance.
(iii) Take over 2nd Bde. barrage (on protective line second objective) while latter were on the move.

A formal Group Operation Order was issued with an Objective Map during the morning of 17th. The Barrage Map did not come till much later in the day. The O.O. :—

(a) Ordered the manning of the permanent O.P's, and that each sub-group should find a travelling F.O.O. in addition and a Forward Intelligence Officer. (6.)
(b) Announced definite arrangements with R.E. and No. 1 Section D.A.C.
(c) Announced contemplated participation of Y/6 Trench Mortar Battery.
(d) Allotted valley in X 8 (a) and (c) for "forward wagon lines"; said that "rear wagon lines" would not move East of valley lying S.S.E. of Villeveque pending developments; subject to these principles, sub-group commanders could use their discretion as regards moves of wagon-lines. (2.)
(e) Headquarters Left Group X 4 d 1/7, then with 16th I.B.; 2nd Bde. R.F.A. R 34 c 3/5; 14th A.H.A. Bde. near level crossing in X 3 a; 161st Bde. R.F.A. X 3 a 2/3.
(f) All parties to be in position by midnight 17/18.
Fourteen copies of this O.O. had to be issued.

At a conference 2 p.m. 17th, the communication arrangements were explained.[1]

At the last moment it was necessary to issue special instructions to Y/6 T.M.B., (armed with mobile 6-inch Stokes Mortars). These instructions contemplated advance behind 2/York & Lancaster Regiment to the first objective and engagement of obstacles such as Fresnoy le Petit Cemetery between first and second objectives. (7.)

Arrangements were now complete for the battle except :—

(i) Barrage map with rates of fire not yet arrived.[2]
(ii) Synchronisation hour not definitely settled.
(iii) Zero hour not yet announced.

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[1] Lateral communication with the group on our left was to be obtained through 14th A.H.A. Bde. (proved successful). Lateral communication with our Right Group was not possible except by orderly, an unsatisfactory condition for which we could not be held responsible.

[2] Tasks for the howitzers and Rates of Fire for whole group only arrived at 19.45 hrs. The Meteor was received over the telephone at 00.05 hrs. on 18th from D.A.

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It had been difficult throughout the time, on account of distance, to obtain personal touch with Headquarters 16th Infantry Brigade, whom the Left Group was to support.

Comments on Chapter I.

(1.) As usual when a large group is found, it was necessary to extemporise a staff for 2nd Bde. R.F.A. Sub-group. Such an arrangement cannot well be avoided, but tends to lessen efficiency. The group commander took the Brigade Signal-Officer and a spare subaltern as orderly-officer. 2nd Brigade was commanded by its senior major with the Brigade Orderly Officer as adjutant-and-signal officer. (The adjutant was unfortunately sick at the time). In this case it was expected that the B.G.C. 16th Infantry Brigade would be much on the move, but everything had to give way to the principle that the group commander must be with the infantry commander.

(2.) It is always a question as to who should be responsible for moves during a battle of wagon-lines, the Divl. Artillery, the Group, the Brigade, or the Battery?

(3.) Both on this occasion and on many others, especially in October, delay in settling the location of infantry brigade headquarters seriously hampered efficient preparation for artillery support, the basis of which is good communications.

(4.) By this time it had become the drill in the 6th Division to synchronise twice daily, whatever extra arrangements might be made for special occasions. The original idea was to prevent overhearing by the enemy, but from a general point of view the custom proved very satisfactory.

(5.) The French area included two localities known as Round Hill and Manchester Hill (further South), which dominated the glacis E. of Holnon Wood and whose possession by the enemy rendered our attack on the Quadrilateral (W. of Fayet and N. of Selencey) most difficult. These two localities had already become famous during the German March offensive. The French now found them a serious obstacle and only completed their capture on Sept. 26th; it was this which caused the trouble about the Quadrilateral, which in its turn impeded the efforts of the 16th Infantry Brigade against Fresnoy-le-Petit.

(6.) Information reaches Infantry Brigade Headquarters slowly in battle, and comes from infantry sources only. The permanent O.P's must remain manned, but cannot see all localities. From this date on, as a result of his experiences in March and April 1918, the Brigade Commander invariably detailed (a) travelling F.O.O's, whose duty was to procure artillery support to meet special circumstances, by any means available, also (b) Forward Intelligence officers, who reported events direct to Group Headquarters. Their task was difficult and uncertain and success depended almost entirely on the individuality of the officers thus employed. Some reports were quite invaluable. It

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was lucky we had almost always enough spare subalterns to allow of such extra work not contemplated by the Training Manuals.

(7.) Y/6 T.M.B. section did not arrive in time to take part in the battle. This was no doubt a failure of organisation and the Brigade Commander pressed very hard for (and would have been given) permanent affiliation to the 2nd Bde. R.F.A. of at least a section of mobile trench mortars. During the period Sept. 19/23 he put up the section commander at Bde. Headquarters, endeavoured to train the section, carrying out practice shoots, and providing drivers from 2nd Bde. to take charge of the animals lent (by order) to Y/6 T.M.B. It was rather surprising that, in spite of the lessons taught us by the Germans in their Spring offensive in the use of mobile T.M's, we made a poor show with them when our turn came. One supposes it was the transport question; but all requests for suggestions began "No extra transport can be provided", which presented an impasse. On this occasion they would without doubt have proved helpful.

CHAPTER II. Sept. 18/19.

At 04.00 hrs. on 18th, B.G.C. 16th Infantry Bde. decided to move into St. Quentin Wood. (1.) The Group Commander accompanied him with one officer and two orderlies and ran out a line to Group Hdqtrs. X 4 d 1/3. It was raining in torrents and the wood was under a fairly heavy fire.

The barrage opened well at 05.20 hrs., and, when the pause on the first objective arrived, all seemed well. 161st Bde., R.F.A. moved up, battery by battery at 5 minutes interval, without interference, into the area R 36a (Position No. 3.), whence it took part in a portion of the next barrage.

The dark and the mist had however caused loss of direction and confusion amongst infantry units. It was soon known things had not gone very well for 71st Infantry Bde. on our right. When the second barrage had been completed, information was almost entirely lacking, and it became a question what to do about the advance of 2nd Bde., R.F.A. This sub-group was of course the nucleus of the Left Group; the other brigades might be called away at any moment; one had to think of defence against a possible counter-attack. The Group Commander decided to keep 53rd Battery at R 35 a 2/2 (7) and advance the remainder of 2nd Bde. to area R 35 d and X 5 b (Position No. 3); the advance was carried out by batteries (by sections of 87th How. Battery) between 11.00 and 11.30 hrs.

B.G.C. 16th Infantry Bde. now moved his headquarters to the Quarry X 5 b 9/9, where his three battalion commanders were. (1.) Casualties in and round about the quarry had obviously been heavy and continued to occur all day[1]; there was also some gas.

The information obtained from 12 specially detailed officers (3 F.O.O's., 3 F.I.O's., 3 "travelling" F.O.O's., and 3 Liaison Officers)

[1] 30 men were killed at the Quarries before noon.

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was poor (2.), but in time things got clearer. Between 11.55 and 12.25 hrs. it was possible to issue a provisional protective barrage line, with a considerable amount of information, to all three sub-groups; this barrage line ran S 3 central—M 34 a 5/0—M 28 central—M 22 central; it was thought we held Fresnoy—and probably we did at that time; the situation at Holnon village was not known. The above line was amended at 13.37 hrs. to read Western point of Fayet—M 28 d 9/5—M 28 b 5/8—M 22 d 1/0—M 22 central (i.e. along Argonne Trench). A provisional Group Operation Order issued later confirmed this and ordered 14th A.H.A. Bde. to remain where it was, 161st Bde., R.F.A. to withdraw 2 batteries to their old position in X 4, 2nd Bde., R.F.A. to withdraw 1 battery 18-prs. and 1 section 4·5″ Hows. to original positions; the Group Commander would remain as Group Liaison Officer (3.) with 16th Infantry Bde., but Group Headquarters would remain at 4 d 1/3.

Later, the whole 2nd and 161st Bdes., R.F.A. were withdrawn to their original positions, except 2 forward sections each. (Position No. 4.) The defensive barrage for the night was fixed at 21.45 hrs. on the protective line to the morning's First Objective. It was proving difficult to communicate with the Right Group in order to fix a junction point. Ammunition had to be obtained and some guns sent to I.O.M.; casualties had been fairly heavy, especially in 14th A.H.A. Bde., one of whose battery commanders had been killed. Harassing fire was arranged for the night at 21.26 hrs.

The Group Commander had been able during the afternoon to visit most of the batteries in their forward positions, but was not altogether satisfied with the steps taken to attain tactical efficiency, such as "shooting themselves in", local observation, etc. (4.)

The R.E. had not been required. No. 1 Section 6 D.A.C. had done excellently. Y/6 T.M.B. had failed because the animals provided could not bring the mortars into action.

Things were settling down and one was thinking of some rest, when at 23.55 hrs. arrived an order to renew the attack under a barrage at 05.30 hrs. on 19th. (5.)

The infantry knew but vaguely where their men were, so mixed were units; the forward area was under heavy and continuous machine-gun fire and air-bombing—no doubt in accordance with the plans for defence of the Hindenburg Line; it was not feasible for a company commander to light a match to read an order. The Group commander's line to Group Headquarters was smashed at 23.50 hrs.; there were no maps to issue, and most of the barrage maps had been destroyed by the rain. The original barrage must be modified to meet the Right Group barrage and had become more than complicated. (6.) But what does one go fighting for except to meet such difficulties?

Warning was given at once and an Operation Order prepared by 01.40 hrs., but—what was better—it proved possible to get Sub-group Commanders 2nd and 161st Bdes., R.F.A., to visit Group Commander at Infantry Bde. Headquarters; the former left the Quarry at

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03.00 hrs. and the latter at 04.25 hrs. The new divisional order had transferred 14th A.H.A. Bde. to right group. As already said, the real complication lay in applying the new barrage lines to the old barrage-map, for the Right Group had had their orders many hours earlier (and the Right Infantry Bde. had not made as much progress). In the event, all batteries of 2nd Bde., R.F.A., and two of 161 carried out the whole barrage, sheets for the later stages being prepared while the earlier ones were being fired; the remainder of 161st batteries joined in after a time. The attack failed[1]—but what could one expect under such circumstances? (6.)

On 19th, the Group Commander, having now only two sub-groups, resumed personal command of 2nd Bde., R.F.A., replacing himself for the time at Infantry Bde. Headquarters by a senior major. During the afternoon instructions were issued for re-organisation of the newly constituted group, based on a temporarily defensive policy.

The batteries were now disposed (Position No. 4.) :—

Two sections 161st Brigade, R.F.A.	In R.36 a	Range to Defensive Barrage Line 2800^{x}
Remainder 161st Brigade, R.F.A.	,, X 4	,, ,, ,, ,, 5000^{x}
21st Battery, 2nd Brigade, R.F.A.	R 34 d 9/6	,, ,, ,, ,, 4400^{x}
One Section, 42nd Battery, 2nd Brigade, R.FA, ...	R 35 central	,, ,, ,, ,, 3500^{x}
Remainder, 42nd Battery, 2nd Brigade, R.F.A. ...	R 34 a 7/2	,, ,, ,, ,, 4800^{x}
(7.) 53rd Battery, 2nd Brigade, R.F.A.	R 35 a 2/2	,, ,, ,, ,, 3800^{x}
1 Section, 87th How. Battery ...	N.W. Corner of Copse R 35 Central	,, ,, ,, ,, 3500^{x}
Remainder ,, ,, ,,	R 34 d 5/8	,, ,, ,, ,, 4500^{x}

Forward sections to maintain active sniping policy in closest possible liaison with the infantry; remainder (at request of the infantry) to keep as quiet as possible. Observation, reconnaissance, and communications required early re-organisation. A dividing line for bombardment was given, 161st on right, 2nd on left. The line being consolidated by the infantry ran junction of Douai Trench and American Alley (M 33d 8/6)—old C.T. about M 27 d 1/3—spur in M 27 a and c—M 21 c 3/2. Infantry Bde. Hdqrs. in Quarry, Group Hdqrs. at present R 34 c 3/5.

It had been a hectic time!

[1] We lost also the ground which had to be evacuated to allow the barrage to be fired at all. At least one company never received its orders to attack.

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The French on our right had been unsuccessful. Our own right (71st) Infantry Bde. had failed against the Quadrilateral, the tanks having proved unable to provide the necessary support. The left (16th Infantry Bde.) had gained its first objective as had the right brigade of the 1st Division on our left, while their left brigade was well forward connecting up with the Australians beyond the second objective. The obstacle had been the continued possession by the enemy of Round and Manchester Hills, which permitted a very fine defence by 280th I.R. of 82nd (German) Reserve Division of an 'advanced post' viz, the Quadrilateral. The 6th Div. Infantry were not to be denied, however, as time would show.

Comments on Chapter II.

(1.) These moves of Infantry Bde. Headquarters might have been settled beforehand, but, to the very end, the artillery was expected to bring instant fire to bear wherever wanted without being given a fair chance to lay the necessary communications.

(2.) It should be one of our chief training-duties to insist on good information in battle from batteries, and on messages correctly timed, dated, etc.

(3.) No matter how inconvenient, it was here as everywhere the first necessity for Infantry and Artillery Commanders to be together. Only in a limited operation, when everything goes according to plan, can the gunner remain at home; it follows his home should be alongside the infantry home; if the infantry are to choose the home, they must choose it in time. As a matter of fact this should, if in any way possible, *be arranged by Divisional Headquarters* when organising the battle?

(4.) In his article dealing with the F.A. group in retreat, the writer laid great stress on the danger of allowing a certain inertia to overcome the personnel of a battery after changing position. It is the time of all others "to get a move on" and it is essentially the duty of the Brigade Commander to ensure this.

(5.) It was a matter for regret that the *one* (Divisional) orderly, who brought this highly important operation message, came last of all to the only Infantry Brigade (16th) which had not had previous warning that the attack had to be renewed.

(6.) Throughout his experience the author has never met a case in which an attack, renewed at such short notice and after initial failure, has succeeded—unless the circumstances have been exceptional. Such an attack has frequently been ordered, but the outcry of those who have to carry it out has generally availed to cancel the order. A special circumstance is, when an objective has been already gained and is solidly held in certain places, which become pivots for the renewed attack, and provide flanking fire; a case of this kind comes to the author's mind in which a party of Highlanders had established itself on the final objective—and was thought to have gone West (or rather

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East!); as a result of their determination, on a whole divisional frontage, troops were enabled to occupy the original objective several hours late but (in their second effort) almost unopposed.

(7.) We had become so used to attack with a limited objective, in which all could be arranged beforehand, during the early years of the war. The guns, more often than not, remained in their original position until the captured ground had been thoroughly consolidated. In a battle of movement, one may have to turn at any moment from attack to defence, or vice-versâ. It is therefore always sound to dispose a brigade or group of field artillery, to a certain extent, in depth. 53rd Battery position in this instance presents a good example of the advantages to be gained thereby—it was suitable for close support or defence. The officer at this time commanding 53rd Battery had a singular gift for choosing positions of tactical value for both offence and defence. Such positions have generally to be kept fairly quiet and are not much used for harassing fire, etc., consequently they require less haulage of ammunition—which may have had something to do with this officer's keenness in the matter.

CHAPTER III. September 20/24.

There was much to do during the interval before the next attack (to complete IX Corps objectives of 18th). 3rd Infantry Brigade (1st Div.) extended its zone towards us, and was for a time covered by our left group—which meant a lot of visiting. There was some fear of counter-attack; advanced sections would have to repeat S.O.S rocket signals for information of the main positions (because of the woods); a deal of counter-preparation (CPN) and harassing fire. Observation was organised by each sub-group in depth, very careful arrangements being necessary to ensure that certain specified areas could be seen; direct communication between certain O.P's and Infantry Bde. Headquarters was established. It required constant attention to achieve the maximum efficiency from the Signal Section. (1.) Positions had to be selected for the next attack, which would allow of emplacement of other (1st Div.) batteries in the Left Group area. 16th Infantry Bde. plan of attack was not decided for some time, because counter-attack from the Hindenburg Line against any initial success needed consideration. It is pleasant to relate that the infantry seemed particularly well satisfied with our support on 18/19 and had written specially to the Divisional Commander; we knew what a difficult task was theirs, and there was great keenness in all ranks of the artillery to help them, based on a long-established Divisional *esprit de corps* and a lucky lack of unfortunate incidents.

Orders were issued on September 23rd for the attack on 24th.

The barrage instructions were in greater detail and of more complicated nature than usual; in view of likelihood of counter-attack, one 18-pr. battery of each brigade was superimposed over the sub-group front, ready for eventualities; there were quite a number of special

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"tasks" to be allotted; gas was to be used on certain areas under particular sets of circumstances[1] (wind, early success, etc.) Y/6 T.M.B. followed 14th A.H.A. Bde. to the Right Group. 16th Infantry Brigade had a first and second objective; 2 battalions in line with certain special flanking parties; Infantry Brigade Headquarters in the old Quarry and all battalion headquarters in Trout Copse. The new "Loop (wireless) Set" was placed in a selected Group O.P. as an alternative method of communication with either 16th Infantry or Group Headquarters; the various observation, intelligence, and liaison, officers were chosen with particular attention to their individualities; the travelling F.O.O's and F.I.O's were instructed to report personally in case of a serious hold-up with the most detailed information obtainable. All sorts of arrangements were made for early news of counter-attack, involving rockets, aeroplane signals, etc. The new positions (Position No. 5.)[2] were to be occupied early in the night 23/24, leaving sections in the old positions to carry out certain fire-concentrations, which sections must join their batteries after completion of tasks. Batteries were to be ready to move directly the barrage had been fired into already-reconnoitred forward areas; the eventual distribution of the Left Group to be in depth, this object being attained by withdrawal (if necessary) of a portion of 161st Bde., R.F.A., to a range of 5500 ᵡ from the final protective barrage line. And so we come to the attack.

The general trend of events on 24th was, briefly, as follows. The French captured Round Hill and a part of Manchester Hill; the 18th Infantry Bde. on our right was, in spite of considerable tank reinforcement, again held up by the Quadrilateral, but 11th Essex on its extreme left got a precarious footing in the S.W. corner of it; 16th Infantry Bde. did well, getting its objectives, and securing the whole Northern face of the Quadrilateral; 1st Division captured Fresnoy-le-Petit[3] and Gricourt. All was not yet over, however, for 1/Leicestershire Regt. of 71st Infantry Bde., attached to 18th I.B., made a gallant and successful moonlight attack on Douai Trench at 23.00 hours, from which, during the 25th, the 18th Infantry Brigade completed the capture of the Quadrilateral by as fine a bit of genuine infantry trench-fighting as could be found in the history of the war. It is strange that on both occasions on which the old 6th Div. came down to the Somme, it should have had to run its head against a "Quadrilateral"!

As for the Group—the barrage, one may hope, was fired according to plan and assisted the infantry. 161st Bde., R.F.A., put down a heavy barrage against alleged enemy reinforcements in the course of the morning, and the 1st Divisional Artillery smashed an attempted

[1] One has heard of a horse called "Circumstances," because no one ever had any control over it.

[2] Position No. 5 as marked on map shows not only the positions occupied for the battle of 24th., but includes a number of positions occupied by forward sections on the night 24/25 and used for sniping purposes during the period 25/28.

[3] A "pocket" of Germans held out in the N.E. corner till night, giving much trouble. During night 24/25 they surrendered to the number of five officers and over one hundred men.

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counter-attack in M 17c; later the 1st D.A. Right Group requested our assistance in minor operation about Dum Copse. At 16.10 hrs., during a personal liaison visit, the Group Commander was asked to support a local offensive by 3rd Infantry Brigade, to be flanked by 16th I.B; B.G.C. 16th concurred; it proved possible to give orders verbally to most batteries and the barrage was fired at 17.30 hrs. Our howitzers answered a few "zone calls". It was 02.00 hrs. before a personal visit to Right Group made it possible to fix the barrage for the night.

The search for information had this time been far more successful—but then the infantry had succeeded, which makes all the difference; two or three first-class reports were received; but unfortunately we lost an officer wounded at an O.P.—perhaps the most experienced of those detailed for intelligence duties. 2nd Bde., R.F.A., was lucky not to lose also the services of one of its battery commanders, who was hit about this time, but only very slightly; anyway we lost same for a time when he went on leave. (2.)

Comments Chapter III.

(1.) The composition of a Field Artillery Brigade Headquarters[1] including as it did personnel from two separate corps, tended perhaps towards a certain strife. Also the Bde. Commander was not, strictly speaking, the Bde. Staff signaller's C.O. (as he was of the battery signallers). One did at times find a little difficulty in insistence on the best signal discipline plus perfect harmony. No doubt all this has been considered in the new organisation, though the millenium is not yet.

(2.) Not the least of a regimental commander's tasks was to fill *suitably* temporary vacancies in responsible posts. The moment under consideration provides a good example; the Brigade Staff was in a crisis consequent on sickness and leave; two battery commanders' leave overlapped; one captain was suddenly promoted and another wounded. Leave was so much looked forward to, and so invaluable in its effects, that few C.O's would have thought of keeping an officer back whose turn for the shore had come; besides one could reasonably rely on his being alive for the next affray.

"He who three-monthly got his leave,
Did live to share more battle's grief."

CHAPTER IV. September 25/30.

By dawn 25th, Left Group had been reduced to 2nd Bde., R.F.A. alone; from 10.33 to 11.15 hrs. it was engaged in answering an S.O.S. call. News arrived that during the previous night the horses, especially those of 87th Battery ("forward" wagon lines, up against the railway embankment near Marteville) had suffered severe (46) casualties from air-bombing; it became advisable on "flying nights" to move horses after dusk and to disperse them in the open—extra work and incon-

[1] Not peculiar to field artillery.

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vience; what made things worse was the great distance back of the rear wagon-lines, due to "circumstances over which the Group Commander had no control." (1.)

On 26th dispositions were modified; 21st and 42nd batteries were to cover right and left battalions respectively—night lines to be arranged in consultation with battalion commanders; 53rd and 87th batteries were retained in the Group Commander's hands; forward sections to do as much as possible of the necessary shooting; defensively, batteries in case of S.O.S. were to fire on their night-lines till otherwise ordered. Lewis guns were now distributed, two at gun-line, one at forward and one at rear wagon-line. (2.)

Very heavy harassing fire was ordered by IX Corps for night 26/27. (3.)

On 27th it was notified that 6th Division might have to advance in sympathy with troops on its left, and arrangements for cutting passages through the wire had to be considered; also to push sections forward in close touch with the advancing infantry; these preparations were decentralised on to the shoulders of O's.C. 21st and 42nd batteries. Two German 77 m.m. guns had been salved by us the previous night and were put into action.

On 28th the enemy disappeared from our front, probably (we thought, and correctly thought) to a line just E. of Fayet, as shown on a just captured map; the infantry brigade on our right established patrols on three sides of Fayet. The rear wagon-lines were at last moved up to about some 4 miles behind the gun-line. (1.) An Operation Order was issued for co-operation by 6th Div. with the attack further north; it might be necessary for our infantry to advance, but the O.O. contemplated principally a prolonged barrage against enemy reinforcements moving N. towards the centre of disturbance —i.e. the intended crossing of the canal at Bellenglise by 46th Div. There were three points of special notice in the O.O., (i) Action to be undertaken by the French, and possibility of action by the enemy, on our right, south; (ii) extension of front by the left group (2nd Bde., R.F.A.) to cover also 71st Infantry Brigade coming in on the left of 16th Infantry Brigade in relief of 3rd Infantry Brigade; (iii) possibility of advance by 6th Div., which was interpreted at Divisional Headquarters into an order to 2nd Bde., R.F.A., to move during night 28/29 to more forward positions whence the morrow's barrage would be fired—though it was perfectly possible to fire it effectively from present positions. To (iii) Left group commander put in an objection, not only for the reason given, and that batteries would have to advance at the moment when, and into the area where, enemy harassing was at its height, but also because there was still a certain instability on our immediate right, southern, flank. The objection was overruled; the batteries advanced by sections (Position No. 6.), so as to leave at any moment 4 guns per battery capable of firing on their night lines. A good few casualties occurred, as expected, during this move, which called for able battery-leading. (4.) Group Headquarters also moved, to Quarry X 5 b 9/9

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alongside 16th Infantry Bde. The Bde. Signal-Officer was wounded in an unsuccessful attempt in company with a wireless officer (also wounded) to get the C.W. (wireless) set into position. (5.)

The night 28/29 had been an unpleasant one—very dark and wet, everyone on the move, heavy shelling and much gas, and quite a number of casualties; but the morning found us merrily firing our barrage, which lasted several hours (3000 rounds by zero + 512′) and left us in the immediate necessity to bring up more ammunition.[1] News arrived that the French would relieve 6th Div. (infantry) during night 29/30 and that the French artillery would come in when the French commander was satisfied. The whole afternoon was spent in getting things ship-shape for them to take over our new area as a "going concern", and in preparing as best we could for our own relief; there was much to do in clearing ammunition, for by this time the countryside, in which we had been fighting since 18th, was littered with small dumps.

During night 29/30 the French Infantry (47th Chasseur Division) duly relieved ours. Our hearts were gladdened with knowledge of 46th Div. success at Bellenglise, by a rumour of American success further north, and by news of the advance of II Army in Flanders and of the retirement of the Germans before General Mangin from the Chemin des Dames; I Army had also achieved success in crossing the Canal du Nord on 27th and we knew the Canadians were moving.

At 13.35 hrs. on 30th arrived the French field artillery group commander (three 75-m.m. batteries) who was to take over the whole 6th D.A. front (six 18-pr. and two 4·5″ How. batteries). He declined to look at the Right Group area, but walked with the Left Group Commander round our positions, returning to Group Headquarters at 15.30 hrs.

At 15.48 hrs. he came into the office and said "We are going to attack under a creeping barrage at 17.00 hrs. I cannot help" and vanished. There was a perfect uproar in the (now French) quarry, but it was "la mauvaise humeur du maréchal"—and that was all to be said about it! Very little talk of objections, evidently. It was an interesting exposition of Gallic psychology and of the discipline insisted upon in their higher ranks.

By the grace of goodness the telephone lines held. At 16.00 hrs. the (French) infantry commander gave the (British) group commander his objectives and general instructions for the barrage. Between 16.20 and 16.30 hrs. it was possible to give all batteries of the left group (now fourteen 18-prs., five howitzers, and two 77 mm's) the right and left flanks, the first line, the pause, the final protective line, lifts, and zero; and at last[2] at 16.50 hrs. connection was obtained with

[1] 250 rounds per gun.

[2] This was the third time during the period covered by Part I. in which difficulty had been encountered over communication with our neighbours. It was due chiefly to the wood, but it was a warning against a similar contingency in the future. There is no idea of imparting blame to the Right Group for this failure; the Right Group had had its hands very full with the Quadrilateral in front of them, and the French to their right.

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the Right Group, who promised to join in, while the British liaison officer with 47th Chasseur Division notified the right flank of a barrage about to be fired by 1st Division.

At 17.00 hrs. the barrage commenced. At 17.10 hrs. the French commander said his infantry had not started; would we begin again at 17.30 hrs.? Followed another hectic period and at 17.30 hrs. we re-opened. The frontage of the left group barrage was 2000^{x} contracting to about 1200^{x}; there were ten 3-minute 100-yd. lifts, then a pause of 15 minutes, then another twenty 100-yd. lifts to the final protective line. It began 'intense' and went through 'rapid' to 'normal', using nominally about 360 rounds per gun.

At 19.30 hrs. the group had finished its ammunition, reached the final protective line, and the utmost limit of gun-range (6.). It was lucky the division had insisted on advance, and the Group Commander on the dumping of 250 rounds per gun after completion of the barrage of 29th! Whether this 'lightning' barrage was satisfactory, or what measure of immediate success the French achieved, has never come to the writer's knowledge; one was doubtful at the time, but the French entered St. Quentin next day without a fight. During the barrage the French batteries had pulled in alongside ours—with their long range, the positions were good enough; and at 19.45, the 2nd Bde., R.F.A., was allowed to go, spending the night in the wagon-lines and moving to Monchy Lagache next day.

Everyone knows Bairnsfather's picture of the battalion officers after completion of relief for the Nth time; but on this occasion there was some extra joy about. Good news had come from Palestine, Salonika, and the Argonnes, as well as from our immediate neighbourhood; DOUBT had vanished. We had been engaged in 4 actions without any known loss of credit, and with, on the whole light casualties (except in horses).

The period had been chiefly remarkable for intense activity at night. Every fold in the ground had received enemy attention; it was what one would expect when approaching a fortress—and indeed part of the Hindenburg line defence scheme was published, which showed the areas needing the special attention of the German artillery and airmen, should the Allies ever attack the fortress. It is perfectly true that it does not matter where you meet the enemy, so long as you do meet him and beat him; but the Hindenburg line possessed a very material strength besides great moral value as an outer wall of the Fatherland. Many British divisions had learnt that!

Comments on Chapter IV.

(1.). The distance of the rear wagon-lines from the front exceeded that of Ypres days, when the guns were on the Ypres—Dickebusch line and the wagon-lines some miles W. of Popperinghe.

(2.). The Lewis-guns provided for the artillery were considered a part of the divisional anti-aircraft defence and were echeloned accordingly.

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(3.). It was a 2nd Bde. custom to get foolscap-sized sketch maps hektographed, and to illustrate all orders for harassing fire, etc. It gave a good deal of work in the brigade office, but the result was undoubtedly worth it, directly fighting came to a stand-still.

(4.). The insistence of divisional headquarters on the advance of the Left Group batteries was justified by the unexpected turn of events on 30th, as well as by the possibilities of 29th; but there were serious arguments against it, one of which (losses to the batteries) was also justified in the event. The incident illustrates fairly well the principle that, in the offensive, supporting artillery must provide for the future by getting as close up as safety permits.

(5.). Complete decentralisation is not feasible where the battle is on a very wide front and each part dependent on its neighbour. Therefore one must control artillery. To control, one must have good communications. Communications were throughout the period covered by Part I. a source of great difficulty. This was no doubt due in part to the system of command organisation (i.e. the splitting up of 2nd Bde., R.F.A. staff into Sub-group Headquarters, Group Headquarters, and Infantry Bde. liaison, on 18th September). Another, technical, difficulty was the interference of the high trees of St. Quentin Wood with wireless arrangements. But one certainly did at times think longingly after the old "bury" of trench-warfare days; one realised the need for that improvement in communications mentioned in the Preface (Lieut.-Col. Broad's article), especially in the efficient practice of wireless telegraphy.

(6.). The simultaneous arrival at the end of ammunition, limit of range, and final protective line, was due to circumstances, and probably unique.

(To be Continued.)

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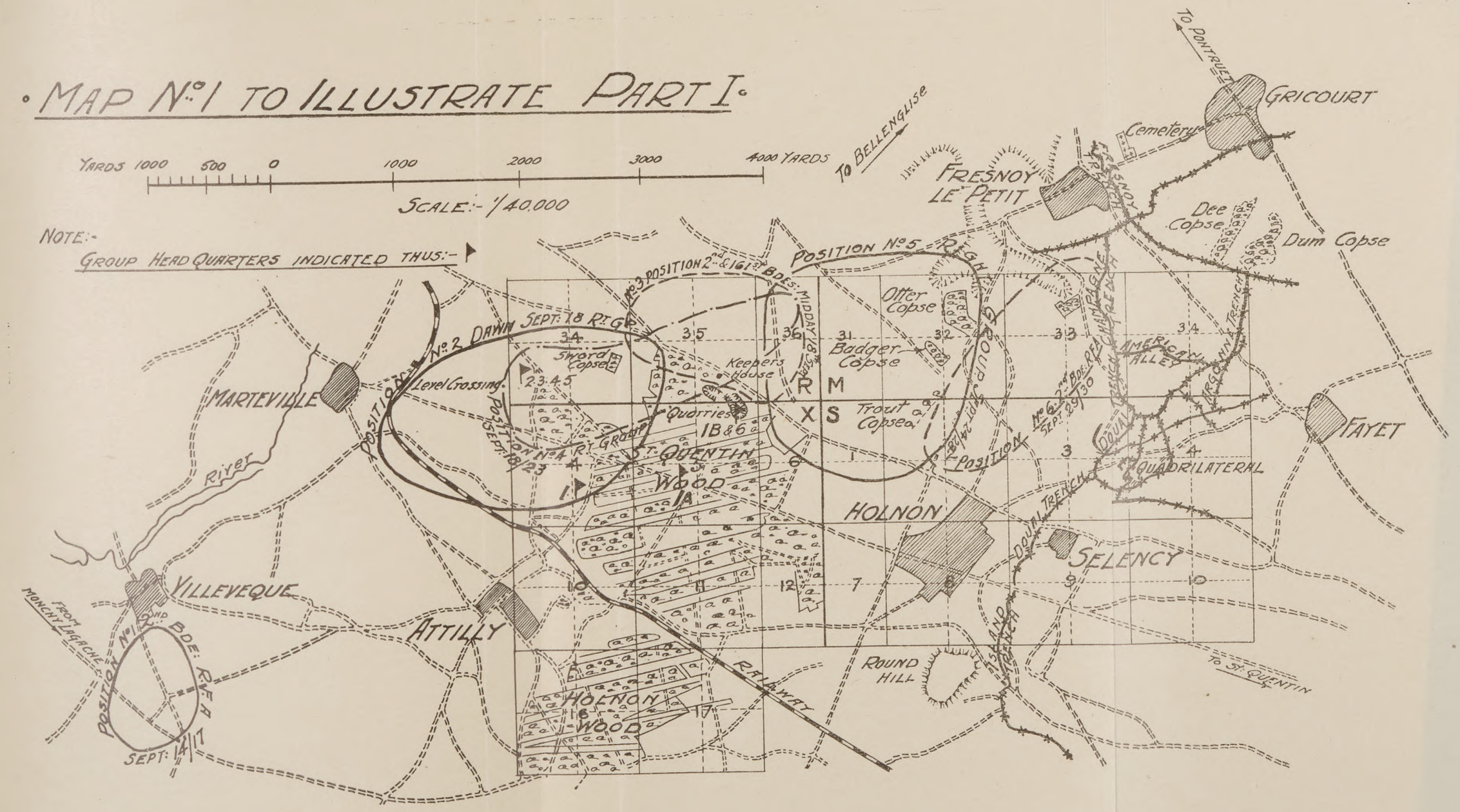
MAP No. 1 TO ILLUSTRATE PART I.
YARDS 1000 500 0 1000 2000 3000 4000 YARDS
SCALE:- 1/40,000
NOTE:-
GROUP HEAD QUARTERS INDICATED THUS:-
TO BELLENGLISE
TO PONTRUET
GRICOURT
Cemetery
FRESNOY LE PETIT
Dee Copse
Dum Copse
POSITION No. 5 R.F.A. GROUP
No. 3 POSITION 2nd & 161st BDES: MIDDAY 18th
No. 2 DAWN SEPT: 18 R.F.A. GR.
Sword Copse
Level Crossing
Keepers House
Otter Copse
Badger Copse
Trout Copse
Quarries
IB & 6
ST. QUENTIN WOOD
POSITION No. 4 R.F.A. GROUP SEPT. 18/23
MARTEVILLE
River
HOLNON
SELENCY
FAYET
QUADRILATERAL
AMERICAN ALLEY
DOUAI TRENCH
VILLEVEQUE
ATTILLY
FROM MONCHY LAGACHE
POSITION No. 1 2nd BDE: R.F.A. SEPT: 14/17
HOLNON WOOD
RAILWAY
ROUND HILL
TO ST. QUENTIN

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WILD LIFE IN KURDISTAN.

BY LIEUT.-COLONEL F. R. MAUNSELL, C.M.G., C.B.E.

ON the high plateau of Eastern Turkey, in the days before the war, a few British Military Consuls were posted to prevent as best they could, the massacres of Armenians which seemed to afford such pleasure to Sultan Abdul Hamid.

As one of these, the writer found himself in the pleasant garden city of Van, on a lake of the same name, some 5400 feet above sea level.

On the far shore of the lake, some fifty miles across was just visible the great crater, five miles diameter, of Nimrud Dagh.

On the north shore in its lonely grandeur rose Subhan Dagh to some 13,500 feet, a strangely impressive mountain, at the first sight of which the pious Moslem is expected to ejaculate Subhan-Ullah—Praise be to God. Hence the name, and certainly when I first saw it, I instinctively stopped to admire its snow capped summit towering alone above the sea of bare hill tops, and felt indeed that the spirit of the Almighty brooded over this great work of nature.

Behind my house towered the craggy summit of Varak where with due care an ibex might be got, and at whose foot nestled a celebrated Armenian monastery where reposed the bones of a monarch of the old Kingdom. But a short distance away was the flat topped crag of Toprak Kale on whose summit could still be traced the great blocks which formed the sacrificial fire altar of an Assyrian temple. At the foot of the slope leading up to the summit was carved in indelible cuneiform characters on the rock a table showing exactly what the faithful were expected to pay to the priest at the temple for the particular sin they may have committed.

Just then the political horizon was clear, the Armenian question was temporarily quiescent and I thought the time favourable for an excursion into the wild hill country south of the lake, to fill in some blanks on the map not previously travelled over by Europeans.

But if we were leaving the Armenian question behind, we were certainly not abandoning politics, for in front of us lay the basin of the Great Zab river in whose deep cut lateral valleys were the homes of the Assyrian or Nestorian Christians, shepherded by a devoted band of English missionaries, with a complete set of troubles all their own, to which the Consul must minister. Besides this there was a Kurdish question which was rather troubling the Vali or Governor of Van, as it did every summer when these nomads began their wanderings.

Between the deep cut gorges of the Great Zab and the south shore of the lake, the hills lost their rugged character and became merged into a series of downs and lofty uplands watered by many streams which joined to form the Bohtan, a tributary of the Tigris.

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On these were the "yailas" or summer pasture grounds of a number of Kurdish nomad tribes who cover these uplands with their tents in summer, each in its own selected area jealously guarded against intruders of any other tribe.

In winter these heights, which are from 7000 to 9000 feet above sea level, are feet deep in snow, and the tribes have then migrated to the Mesopotamian plain beyond the Tigris at Jezire-iom-Omar.

For self defence the tribes generally grouped themselves into a few large confederations; the Hartoshi and the Miran being the principal in this area.

Now, the sower of trouble among his neighbours in this field was Mustapha Pasha, or Musto as the Kurds called him, of the Miran, just then camped in the Bohtan Valley, rather outside the shadowy limits of the jurisdiction of the Governor of Van; and he was much inclined to be independent and to harry his neighbours, especially those of the Hartoshi.

But the great crime in the eyes of all his brother chieftains, especially of Hajji Agha of the Hartoshi, was that Mustapha was of humble origin, a mere retainer of the late Agha of the Miran, who had worked his way up to the leadership by devious methods, alternating with direct violence to those who dared to stand in his path: but who now stood equal in influence and power to the Hartoshi chief himself.

The Kurd, and especially the "ashiret" or nomad tribesman, has a fine air of independence, but before all he is a convinced aristocrat and will have none of democracy and its supposed virtues.

Are they not the descendants of the ancient Medes from whom Cyrus, Saladin, and Nadir Shah sprang and of men who doubtless tested the merits of democracy centuries ago and would have none of it then.

To them therefore Mustapha Pasha was an anachronism and he was hated and feared even by those of his own confederation because of his upstart birth and the breaking of tradition which it implied, but none found themselves quite strong enough to depose him. His title of Pasha was derived directly from Sultan Abdul Hamid himself, as a reward for raising two regiments of the notorious Hamidie Cavalry from among his tribesmen, to serve that sovereign's ends. Thus he felt himself rather above that tough old Albanian, Tahir Pasha, the Vali of Van, although he was one of the best type of Turkish Governors, and affected to care little for him; still less did he care for British Consuls.

So that when I mentioned to the Vali that in my journey I might possibly pass by Mustapha's camps, he merely shrugged his shoulders and was not overpleased, but he supplied me with the usual guard of two "zaptiehs" or gendarmes to represent the Turkish Government on the journey, stating they knew all the paths across the uplands and could speak Kurdish as well.

By good luck I hoped to avoid Mustapha, as he was already some distance off, and moving by easy stages towards his winter quarters along the Tigris.

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As we moved out of Van Gardens our party was composed of the usual elements; M. Sbordoni, the Consular dragoman, an Italian of the Levant and a most gallant sportsman; two consular kavasses, followers who are recognized by the Turkish Government and paid by the Foreign Office as a protection for the Consul when he walks or tours abroad; one was Mahmud, a clerkly personage who could write ornate Turkish letters, a good specimen of the Van townsman, half Turk, half Kurd by race with rather a stronger dash of the latter, but a stout fellow withal.

But the stoutest heart of all was in Bilail Chaoush, or Sergeant Bilail, who bore the name of no less a personage than Mahomed's barber himself, a swarthy native of the Yemen, whom fate had caused to drift thus far north, and who seemed to look on Kurds generally as outer barbarians, but feared nothing they might attempt.

For arms we had two Lee-Metford carbines, handy little weapons which would be useful if we met moufflon, ibex, or bear on the way.

Skirting the beautiful shores of Lake Van past Artemid with its apricot groves and orchards and crossing the Shemiram canal, a small duct which brings water into Van from a spring 20 miles away, and whose name recalls that of the great Queen Semiramis, who was wont to spend the summer in Van and so escape the heat of Nineveh, now the modern Mosul.

We crossed the plain of Havatzor with its many Armenian villages and rich cultivation, and then over a low watershed entered a long narrow valley bordered by bare rocky hills, which we followed to Shattakh, a large Armenian village on the Bohtan, which had suffered but little in the last massacres owing to the protection afforded by local Kurdish chiefs, who refused to carry out the edicts of Abdul Hamid.

Following down the river valley for a few miles, here a gorge with steep sides of bare limestone, we climbed a rough stony slope to the south-west and reached the summit of the Gellizshinan Ridge, which may be called the frontier of the nomad Kurd country and from which was unfolded a wide panorama over brown uplands with occasional wild crags, while distant clusters of black tents revealed to us the first outposts of Mustapha Pasha's redoubtable henchmen.

We were soon to make closer acquaintance with the latter as, when we had wound down the stony slope in front, and crossed the Masiro stream at its foot, we entered a short rocky defile, and were suddenly brought up before a cunningly contrived ambuscade, facing six Martini rifles protruding through rocky loopholes at point blank range.

The zaptiehs in their capacity as representatives of the Turkish Government were called up to expostulate and explain, and then after many wordy exchanges, we passed through this outpost, but with the feeling that we were now really in the clutches of Musto. The great Agha himself was said to be far down the valley, outside our Vilayet boundary, and as our track lay off to the South we camped among his retainers close by; exchanging messages, which were at least outwardly cordial, with the great man. Later in the evening, his son arrived, and was much interested in my tent and all its belongings

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but especially in the Lee-Metford carbine; for weapons of any sort and perhaps field glasses are amongst the few things that really interest a Kurd. Judging from subsequent events this youth must have formed the idea that such a handy weapon would form an acceptable present to his father, and that after all the simplest method of obtaining it would be to hold up my party and carry it off by force. Next morning there appeared from the tents close by, to act as guide, a most ornate fellow festooned across with bandoliers of cartridges while slung over his shoulder was a brightly polished Martini; a fine specimen of the mountain Kurd with piercing eyes and a physique indicating the strength and agility of the native lynx. All day we kept over high rolling uplands 7000 to 8000 feet above sea level, with a splendid panorama unfolding itself at intervals to the west; the ground fell away steeply in that direction and some thousands of feet below we could see across the Bestenjik, or "place of wooded gardens," so called from its forests of fine oaks.

To the north frowned the great flat-topped mass of Halakur mountain rising to 10,500 feet, its face on this side being an unbroken line of limestone cliffs some 1,500 feet sheer, at the foot of which a few black specks denoted Mustapha's tents. Many streams crossed the Bestenjik converging like the sticks of a fan as they formed the Hazil River which plunged into an immense rock gorge in lofty hills to the south from which it emerged some miles near Zakho, now the northernmost outpost of the British mandated area.

Beyond the Bestenjik about 30 miles away were some ridges of lower hills which separated us from the Tigris at Jezire, beyond which were the plains of Mesopotamia.

Immediately below us the dark oak groves of the forest ceased, and were replaced at higher level by a belt of pines, and higher still was a zone where only a dwarf juniper grew with branches straggling along a few feet above the ground. Where we were was treeless. Further on we crossed the Maidan Jashuch "the field of the spy," aptly named from its comprehensive view over all the Bestenjik causing it to be used as an outpost where one tribe might view the movements of some possible enemy tribe as it wound along the well trodden route through the woods below. I had once passed here in June shortly after the melting of the snows, when the uplands were carpeted with short grass glowing emerald green in the bright sunlight, and thickly studded with blue Alpine gentians, star of Bethlehem, many kinds of ranunculus, and on a few stray heights, perhaps 9000 feet, were found the real British primrose and cowslip. Although there had been burning heat at Jezire, a light hoar frost then touched the ground in the early morning. The Hartoshi were here and their chief had sacrificed a sheep in my honour. But while thus lost in contemplation of nature, and in trying to fix distant points with my prismatic compass, the Kurdish guide was apparently also lost in thought but on entirely different lines.

His thoughts ran on how he was to obtain possession of that Lee-Metford carbine, on which his imperious master had set his heart, although he answered my questions as to the names of various places cheerily enough.

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My salvation lay in the fact that I always wore a service revolver ostentatiously displayed on my waistbelt. I wore it because in a country like this, where no Christian was ever supposed to display arms, much less wear them, I thought it a useful way of showing that an Englishman was someone different. My compass was the only survey instrument I displayed, as in this country a theodolite or anything on a tripod would have been recognized by the humblest villager as a means of measuring out the country, and from that to annexation was but a short step in their minds.

And after all when one comes to think of it, the British outposts are now at Zakho, just across the hills from this point.

We now began a long descent of some 3000 feet into the Khabur Valley, hoping to find a village at which to camp, and I detected the Kurdish guide becoming manifestly more impatient; and once he made a movement to unsling his rifle, and almost unconsciously I made a similar movement,which he saw, towards my revolver.

But at the foot of the slope his opportunity came; here was a cup shaped basin without a bush or any cover, in which we collected the caravan before paying off the guide and passing into the village now close by.

I was standing writing up some notes, and about forty yards off the dragoman was settling with the guide. Sbordoni called out that he wanted two "mejidies" instead of the one for which we had already agreed on.

To get rid of him I consented; but as he walked off he unslung his Martini, jammed in a cartridge, and let fly at me, the bullet whistling past my shoulder; he then bounded up the steep slope, knowing he would soon be out of range of my revolver. I ran to the mule on which was packed away the carbine, but before I could get into action kneeling on the grass he had got in two more shots from the bushy slope high above me. But with a magazine carbine he was outmatched, and although I could only see a head behind a bush or stone, each clip from the magazine shifted him higher up the slope, until at last he disappeared on the sky line, with a shout of defiance as he fired his parting shot. I was then giving him what Tommy would call the whole blessed ladder—say 1000 yards on the sight—but he had me at a disadvantage from the first as regards ground.

We camped that night near the village which happened to be one of Assyrian Christians, isolated from their friends and consisting only of a few wretched huts, that seemed to have a hard time to exist at all. They promised us a guide for the morrow. The night was extremely restless, as about 10.30 p.m., shooting began again from points near the sky line from the scrub on the steep slopes, no doubt from my friend of the afternoon still hankering after the carbine.

We stood by most of the night, but beyond a few dropping shots near my tent, nothing serious happened. We made no reply. Next morning we crossed the Khabur, here in a deep valley, passing the charred remains of the village of Elk where the Turkish Government had recently tried to establish a "kaimakam" or sub-governor, but after a short residence the Kurds had expressed their disapproval by

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burning his house over his head, while he barely escaped with his life. Since then all Government had lapsed, and the district had attracted many outlaws and wanted men.

In the dark forbidding gorge from which the Khabur emerged just above us were villages of the Gavdan Kurds, always of a bad reputation, while up the slope in front of us were said to be the camps of the Zshiriki, still more notorious robbers and looked on as outlaws by the Vali of Van. Still we had the day before us and thought we could manage to push through to more friendly quarters in the Assyrian Christian country. All up the steep terraced slopes which we had to climb after crossing the river were dotted the tents of the Zshiriki, and in front of each there might be a couple of gaily dressed fellows lolling about on the grass near the door, each with his Martini not far off and strung about with a couple of well filled bandoliers; such being the constant wear of the young bloods in Kurdistan. All seemed friendly, outwardly at least, and passed the time of day quite cheerily; while our Christian guide, a shifty personage who looked as if he had something weighing on his mind, seemed well known too.

But as I afterwards remembered, there were significant glances passed to each other as much as to say, you can pass on but we will get you higher up, and I think I caught remarks about rifles or carbines.

Here I may remark that the two zaptiehs, representatives of Government, had long since assumed a non-committal attitude, resigning all to the will of Allah, metaphorically folding their hands and waiting on events. In their carpet slippers, and each with an obsolete Berdan rifle across their shoulders they certainly did not present an inspiring picture.

At the top was a wide grassy basin, called the Maidan-i-Ziril, ringed round with rough slopes, at the foot of which were one or two Kurdish tents, not enough, as I thought, to dare to attack us.

The Christian guide had discreetly disappeared a few moments before, the country was unsurveyed and I could see no way forward to the Christian valley of Tiari, so I decided to pitch camp here, find another guide, and start again in the morning.

Manuk, my Armenian cook, certainly had qualms about the situation, as after overhearing some Kurds talking, he was moved to call out in English "Master, these very bad men; they kill you." However only a few tents of Kurds were in sight, and I thought we could deal with them if trouble arose, so my camp was pitched with the aid of some of the Kurds. All seemed friendly, some little children who had crept up were placated and rewarded with lumps of sugar and all was well.

But when tea time arrived I was rather astonished at two headmen from the tents rather unceremoniously pushing open the flaps of my tent door and beginning a rather desultory conversation leading up to the naive remark, "I wonder what your Government would do if you happened to be killed in these mountains," I replied, as if this was quite an ordinary remark, that even at this distance they would certainly find a way to do something, and it would be unwise if anyone did such a thing.

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But what really dominated the conversation and eventually closed it, was the fact that lying on the table within easy reach of my hand was my revolver, and this proved more eloquent than words.

The evening closed in fairly calmly, and following the usual custom, we asked for a couple of men from the tents to act as night watchmen. I was certainly surprised when a little later the two headmen arrived, although some lesser lights might well have sufficed. Sbordoni then came up with the information that Kurds had been enquiring as to the usual hour the Consulos Bey retired to sleep, on which I decided to abandon all repose for that evening.

Then it so happened at 10 o'clock in the bright moonlight, as Sbordoni and I were standing by a small group of boulders, about fifty yards from my tent, a spot giving us a good view, he suddenly pointed towards the Kurdish tents, and there we saw, crawling like snakes through the short grass and stones, a dozen Kurds, each with a long curved sword in his hands which flashed fitfully in the moonlight and betrayed their onward movement. Not a moment was to be lost if the situation was to be saved, so we moved close up to the two headmen, and pressing a revolver on the attention of each, explained in a few short sentences that unless they at once shouted to their men to stop the attack, they would be the first to suffer. They grasped the situation, and seeing that their pleasant little plan of cutting us to pieces had failed, and moreover that we were in earnest, for the revolver barrels were pressing very close, they screamed out some words of command in Kurdish, on which the fellows got up and calmly strolled towards us putting up their swords as they came.

The diplomatic attitude had never entirely been abandoned, a strained air of friendliness was still kept up; why, these men were really only out for an evening stroll, though exactly why they should have gone about crawling in the moonlight with drawn swords, they did not attempt to explain. However their game was up, calm was restored and our night watch was resumed; when somehow I became aware that there was an invisible enemy of unknown strength behind the dark crags that loomed half a mile to the south, and that it was from there that the real attack was to be expected. Now and then our Kurds turned anxious glances in that direction, keeping up a low muttered conversation the while, also a distant barking of dogs indicated the presence of more tents up there. Suddenly a single rifle shot rang out from that direction, but nothing followed; apparently the scheme was that we were to return fire against the invisible enemy and perhaps create confusion from which they might profit, or at least we might be drawn away from our little rocky eminence and an attack might then be developed on our tents from a ravine behind. But I gave strict orders that not a shot was to be fired on our side, and we declined to budge or be drawn. At the first streak of dawn tents were struck and we began loading up the mules. After long haggling for fabulous sums, part to be paid in advance, we managed to induce one of the Kurds to act as guide towards Tiari. Just then a zaptieh had with his usual stupidity rested his rifle against a rock and gone off himself to help to load the mules. This was too much for the feelings of the guide, who whipped up the rifle and with the agility of a cat disappeared down a small rocky ravine, being out of

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sight almost before I could look round, leaving us one less in rifle strength, albeit that was only a wretched old Berdan.

Only knowing roughly the direction of our route, I somehow distrusted the straight track between the cliffs to the south, which I afterwards learned was the direct road to Tiari and on which a strong ambuscade had been prepared to complete my destruction without any doubt or peradventure.

I headed the mules off along a path trending away half left, impressing on the muleteers to hurry along and close up together, telling them that we would keep behind and cover the rear against possible attacks of our friends of last night.

I had taken the precaution to fill my pockets with all spare ammunition and any valuables from my baggage; Sbordoni and I took a carbine each and Bilail Chaoush my shot gun. The mules went off well closed up in charge of a zaptieh, the muleteer being a stout Vanli named Pasha whom I always employed and who was a good fellow that I thought could be trusted.

We followed slowly, watching for some movement from the Kurdish tents behind. We had not gone far before the storm broke, for up on the sky-line on some craggy cliffs to the right, I could see the heads of some 80 to 100 Kurds appearing and the occasional glint of a rifle barrel between the rocks. These were the men of the ambuscade on the main road who had run across, determined not to be baulked of their prey.

A few dropping shots began it, a yell from the direction of our late hosts showed they were awake to the situation, and figures appeared from there racing forward, while at the same time the men on the crags to the right began to clamber down and run across the open towards us, firing as they ran. We had the advantage of being mounted on an open grassy stretch, the attack was on our right flank and rear, so I waited until I saw the mules and footmen disappear over some low mounds quarter of a mile off, and then trotted on to escape the advancing rush; then we reached the mounds which gave us a good position to check the enemy, and gain time for the caravan to push on out of danger.

We thus managed to escape the flank rush and the frenzy of our late friends in the rear, and we dismounted at the mounds and faced the rush. Sbordoni was on a mound one side of the path with Mahmud holding horses, and I was on another with Bilail Chaoush some 20 yards off. The shot gun in Bilail's hands was of no use at all as it turned out, though it perhaps might have been. The horses gave no trouble and took little notice; such incidents were all in the day's work in Kurdistan. The two magazine carbines gave us a slight advantage over the Martinis of the Kurds, who now found themselves in the position of having to attack over quite open ground instead of working the pleasant ambuscade they had planned.

There were at least 100 of them, led by a brilliant figure whom I afterwards learnt was the great Zeko Agha, who bore the reputation of being invincible to rifle bullets as he wore round his neck an unfailing charm in the form of some verses from the Koran.

On came the rush, and I noticed also that heads were beginning to appear over the low mounds to the right and left showing that

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flankers were working round on either side. There was some confusion among the enemy's ranks and a slight check, as Zeko and another stumbled forward and fell, but at the same moment came a cry from Sbordoni "Bey Effendi, they have hit me" and glancing round I saw blood pouring from his left arm, and he could stay no longer. A cry of triumph rang from the enemy and more bobbing of heads on the right and left warned me.

I saw that Mahmud had helped Sbordoni on his horse and both had disappeared safely along the track to the rear.

Bilail Chaoush and I clung on to the last moment, and held the crowd back until they were not fifty yards off. Then he brought up the horses and mounting we trotted off, getting some slight cover from the mounds as we went.

Very soon I was confronted with an entirely new situation, for, having gone not more than quarter of a mile, I came upon an open grassy dip, in the centre of which were my four mules quietly grazing without a sign of muleteers, zaptiehs or Sbordoni. We first tried to drive the mules along in front of us, but let anyone attempt to do this in a hurry, and try to make four mules, who want to graze, move quickly off in any required direction, he will find they will do just the opposite. Such is the obstinate nature of the beast. Moreover the mounds behind became lined with the enemy and a spatter of bullets let us know they meant business. Leaving the mules we pushed on to the far edge of the dip, where Bilail and I dismounted and again I tried to stop the rush and save the mules. It now became a duel at 300 yards range, over the heads of the mules, at the mounds opposite whenever anything appeared. The Kurds were now very wary and nothing but a head showed for an instant, or a fleeting puff of smoke, but I made the dust fly over or near them and gradually there came a lull.

Bilail, who had up to now been handing out cartridges, noticed this, and volunteered to go forward into the open and drive back the mules, while I covered him with my fire overhead.

All this time the mules had scarcely moved, and continued grazing unconcernedly. I had to decide therefore, knowing the obstinacy of the creature, whether they would consent to move at all or in the right direction, if Bilail went down; and also that when the Kurds saw him whether coming they would not concentrate their fire on him.

My faithful friend was practically unarmed and I felt it would be a useless sacrifice of his life, for which a tent and some baggage would certainly offer no equivalent in my eyes.

Also I had noted that the Kurds were again creeping slowly round the right flank and there was quite a group forming on a mound there.

Weighing it all up, I decided not to risk Bilail, so mounting we rode off to collect the remainder of the caravan. Glancing over my shoulder I heard a triumphant yell and down they came like a pack of wolves on the mules.

The first signs of life from the caravan were groans and rapidly repeated prayers from a ravine, out of which I extracted Manuk the Armenian, and further on were the two muleteers dazed and crest-

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fallen, sitting by the roadside, but overjoyed to see us. It was the sight of Sbordoni coming back that had made them go.

Riding along I turned sharply round a knoll and came suddenly face to face with a Kurd, mounted on Sbordoni's horse, hurrying off to escape with his booty. Covering him with my revolver, I made him dismount, unsling his rifle and hand it over, the greatest punishment that one can inflict on a Kurd. Hearing that the dragoman was safe close by, I bade him begone and he was out of sight in an instant.

We mounted Sbordoni again and moving off we noticed some groups in the distance, threatening pursuit, and fired a few parting shots to clear them off. Here for the first time the zaptieh joined in the firing apparently to show that the Turkish Government was at last awake to the situation.

Having collected all the party we pushed on over the uplands and in a short time turned into an open space in front of several tents of Kurds, all of whom were standing in their doors, the men with rifles at the ready.

But it was soon evident we were among friends, the Hartoshi, the sworn enemies of the Miran and their upstart chief Musto. Execrations were heard on all sides that those outlaws the Zshiriki and the Gavdan should have so far forgotten the laws of hospitality as to attack a "musafir," a guest, who was also a consul and therefore "musevi."

They were not strong enough to lend a hand at recapture, but they pointed to some distant black tents at the head of a broad upland valley which I recognized as the Farashin Yaila, saying that those were the tents of Hajji Agha, known as the Agha-i-zor or the Red Agha, chief of the great Hartoshi confederation, whom I knew I could claim as my friend.

As we moved off a fine looking Kurdish woman lying on the grass called out to ask when was the fun going to begin. As a sequel to a day's scrap on these uplands someone usually got carried off and she was looking a bit bored. To the conqueror the spoils is ever the custom of the changeless East.

That as may be, I pushed on after pulling out the prismatic compass to interpolate my position and connect up my survey work, and then an hour's ride brought us to Hajji Agha's hospitable tent.

He was full of genuine concern, but after all what could one expect from such a band of robbers as were the Miran confederation, or from such an outcast as Mustapha their leader.

Sbordoni's wound had now to be seen to and it was found that the bullet had entered the forearm just above the elbow and come out at the shoulder, breaking no bones. The tribal doctor, an expert in bullet wounds, was called in and prescribed the usual Kurdish remedy, which consisted in his producing a ball of bitumen and kneading it up with saltpetre and other compounds or salts, then shaping it like a long pencil and thrusting it slowly up the wound. This formed an excellent antiseptic and was removed a week later in Van, after which the wound healed quickly.

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The first consideration was now to get Sbordoni back safely to Van, and the visit to Tiari and the Christians had to be abandoned for the time. Hajji Agha was willing to lead a rescue party, but Sbordoni had to be taken home, and there were other considerations as well.

After three days of rather painful riding for Sbordoni, we were back again in Van. Old Tahir Pasha, the Governor was much disturbed, but recalled his warning regarding Mustapha and the wild doings of the Miran clan.

Husni Pasha, the military commander, after some delay despatched two squadrons of regular cavalry to the scene, who promptly got involved in an ambuscade in the Gavdan Gorge, were badly cut up, and retreated on Van. Two battalions of infantry were then despatched who scoured the country of as many sheep as they could find, and as many stray prisoners as they could catch and came back triumphantly.

The Governor had his own scores to wipe off against the Zshiriki as the burnt village of Elk had testified.

Four wild mountaineers, the true Kurds of the hills who had never seen a town before, agile as cats and with eyes of the hawk, were brought in as ringleaders, and placed on trial. It was impossible for me to identify any of them, so after a short time I asked for their release and they were sent back to their native fastnesses.

The Armenians took up the whole incident as their own, and wove it into the tangled web of Armenian politics, although none of their people were at all involved; but no doubt Manuk's tales of his valour regarding the incident did not lose in the telling.

As the situation struck Bilail Chaoush, it seems that he was turning over in his mind whether, with the present he had received, he would purchase a fifth wife in addition to the four which he already possessed in accordance with the precepts of the Koran.

But perhaps another sequel may be mentioned, for next autumn Hajji Agha contrived a most wonderful ambuscade for the great Mustapha as he passed down a gorge near Jezire with his Miran, on their annual migration; and not only was their chieftain slain after a desperate struggle, including a rifle duel with Hajji himself, but the whole confederation was dispersed . So Mustapha never got that carbine after all.

My baggage was recaptured and returned; strangely enough with very little of it missing. The 6-inch sextant was there in its box, except that the most important screws had been dexterously removed, and the instrument was useless. Someone who knew, certainly not the Kurds, had done this. Could it have been that orders for its destruction had come direct from Abdul Hamid himself, whose mind overlooked no detail and who had strong objections to survey work by strangers in his dominions. Also could it possibly have been the Sultan himself who had planned the whole affair using Mustapha as his tool. Very little escaped the notice of that wily potentate!

A few weeks later the same band of brothers sallied forth from the Consulate to pay that deferred visit to the Assyrian Christians. The same muleteer, Pasha, was ambling along behind four new mules, which he regarded with a smile of satisfaction as they had been purchased for him at the expense of the Turkish Government.

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Manuk was holding forth volubly from the top of a mule on the valiant deeds he meant to perform.

Bilail Chaoush had a smile of seraphic satisfaction and his thoughts were not entirely of Kurds, so it seemed.

Both carbines were in their proper places.

As we topped the first hill I noticed that the wide valley in front of us was positively alive with sheep, flocks in all directions, converging towards Van.

I turned to the zaptieh and asked the meaning of all this, when he obsequiously replied "Consulos Bey, are they not all yours"?

It seems they were the spoils from the Zshiriki country being driven in to pay off the many scores against that unruly tribe and the zaptieh thus laid them at my feet after the manner of the East.

It was only left for me to ejaculate a long drawn "Mashallah Effendim" as the appropriate remark for the occasion, and then we passed on across the stony ridges in front, to pay our deferred visit to Mar Shimun, the Assyrian Patriarch at Kochannes and to kneel in their national cathedral in the rocky fastnesses of Jelu, which we eventually did without further let or hindrance.

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TRUTHS FROM THE GERMAN FRONT.

Translated from the German by Col. George Ruhlen, U.S.A., Retired.

Review of and comments on a recently published pamphlet written by Kurt Hesse, a German officer, by Major H. Merz, of the Swiss military from No. 22, October 29, 1921, Allgemeine Schweizerische Militarzeitung.

Reprinted from the Journal of the United States Artillery.—April, 1922.

GRADUALLY the veil which covered the collapse of the German military powers is being lifted and strong voices heretofore held down by the force of censorship are being heard and we perceive how finally that which was inevitable had to come to pass. Posterity is enlightened by mistakes. From the mistakes of others we also, whom a merciful fate has spared, may learn. And inasmuch as we have not yet reached the limit of freedom from risks of war, it is our duty to give heed to the voices that would inform us. These are the considerations that have induced me to write what follows:

Aside from the large heretofore well known works of Krauss: "The causes of our defeat," (Lehman, Munich); "Criticism of The World War, By a General Staff Officer," (Kohler, Leipzig,) and others, it is a small, insignificant pamphlet that deserves special attention, because it is written by an officer from the front who, as a subaltern and company commander and later as adjutant, had opportunities for an insight into the whole mess, and this little work we may take up with promise of much gain. Kurt Hesse does not, without cause, call his "Marne Drama of the 15th July, 1918" in its subtitle, "Truths from the Front." (Published by E. S. Mittler and Son, Berlin). Let us then see what he has to tell us:

An exemplary leader must live with his troop. Of course the most unsophisticated individual will admit that the leader has other things to take up his attention than to be constantly in the trenches furthest in advance with his infantry detachments. But in many cases it was not recognized that the men have a desire to see their leader at times, face to face, the leader to whom they are committed for life and death. There was also necessity for the subordinate commanders to have opportunities, occasionally, to give vent to their real opinions, because they knew very well that their reports seldom reached their highest superiors. A personality that sat at his desk only, however capable, could not be in enduring sympathy with his troops, yet that was a positive necessity.

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The younger among the most capable officers gave good account of themselves. Toward the end of the war the need of leaders of the lower grades, from battalion commanders down, was urgently felt. Hesse is of the opinion that at the beginning of the war *half of the officers in active service ought to have been left at home;* that the numerous war volunteers who needlessly and uselessly gave up their lives in Flanders ought to have been held back by force, "then we would have had officers even in 1918. We ought to have learned from the English. They had almost constantly an officer to every 20 or 30 men. But with us the young lieutenant led, even in 1914, 80 men. That was even then difficult and later on in the major battles a monstrosity. The object most to be dreaded is the nervous leader." But we will come to that again later on.

In contrast the calm collected officer was the great bolster in the fight; around him the men collected. They simply did not know where else they should go, saw only him and willingly followed him. The long war of position gave rise to injurious growths; "there came up, in the course of events, much young blood upon which no one had impressed the real duties of the officer and who were lacking in the peace school training."

In judging the soldier an erroneous standard was frequently used; one must always consider that in the first instance he is a human being endowed with all its infirmities and deficiencies. When the needs inherent to the human being were fulfilled he was available for all the demands upon him. The main needs were, when he was exposed in the open, reasonable things to eat and sufficient sleep. For greater permanency there was of course need of shelter, a roof overhead and straw to lie on. During the progress of the war there manifested itself the natural yearning for home, expressed by a desire for furlough, which, it is to be regretted, was not always given proper heed.

The supplies of men became, as time passed, worse and worse, so that the front became absolutely infected. "Mollycoddles" became a habitual manifestation, sense of honour died out under the destructive influence of enemy propaganda, which had created terrible havoc. The men which the home regions sent out were badly trained for want of efficient training centers and cadres. They were wanting in knowledge of field efficiency, because what they learned from an instructor was often in a few months no longer "modern" in the rapidly changing conditions. But what was needed was *Drill.* Moderns see in it only militarism personified, in complete misapprehension of what militarism really is. We can never dispense with drill, even in the most democratically constituted states. By its means only is discipline brought to the troops and the more rigid it is the better will the men be prepared for the contest. The man in the field must be managed, and this he did not, up to the last, in the least resent provided he was properly managed and left in peace and in freedom. One cannot require from men anything that is physically unreasonable.

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Hesse turns with full weight against the nonsensical assumption that every fighter is a hero. This expression became nauseous to the soldiers themselves. Hear what he has to say: "To be a hero signifies going calmly forward to that which is to the human being the most difficult—death. His throat is contracted, he takes a deep breath, he feels as if a heavy weight were pressing upon his chest, he wants to knock down, kill something that is within him. Stomach and intestinal nerves become oppressive and frequently give way altogether. Fear, it is called, but back of it is death. He who has not a valient heart inside of him succumbs and there were many who were not constituted as the people at home believed them to be. Half a year after the beginning of the war there were more heroes than at the beginning because men became accustomed to the infantry fire, the pop of the artillery, the darkness of night and all other uncanny occurrences, and also because they came to recognize what one encounters when he approaches death."

Hesse gives an interesting reply to the question: was the firm *will for victory inherent in the German nation?* "One must answer this in the affirmative and in the negative. Among individuals—yes, without doubt. But in the mass—no, or only momentarily so, when one had succeeded in arousing the stupid. After three years of war in position, after the terrible defensive actions of 1917, a new offensive was generally hailed with delight. We told ourselves that worse than at Arras and Flanders could not happen. Furthermore, back of the offensive was more intense willingness of the mass rather than of the individual. The German could certainly be depended upon as being obedient and was that not sufficient?"

Another point full of instruction: Hesse thinks: "Our leadership was far reaching and ingenious in its method of supply of war material". We would not have been able to hold out so long if the great strength of powerful means of destruction supplied had not stiffened our backbone. But this praise must be qualified with a harsh reproach: however much the highest leaders may have recognized the needs of the front in tactical affairs, it did not always give full ear to it in other matters in the supply of material. Why were, in 1915, movable firing screens supplied by thousands and in 1918 breast plates by the hundred thousand? The home people were astonished by seeing pictures of "knights without fear and without reproach" in armour. The procurement of breast plates involved an enormous useless expense and waste of material, because they were worn only when the superior officer was in sight, or possibly by a Landwehrsman who had left wife and children and home and was oppressed with anxiety on their account; one could neither shoot nor go about while wearing this thing. The front reported at once that they were impractical—we were supplied with new ones. Again we reported for the second and third time, but they continued to arrive. We had the impression that war material contractors had found a good piece of business.

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"In other lines, again, too little was done; we would have achieved a very material and possibly decisive success for the outcome of the war if, instead of the very limited gas attack at Ypres in 1915, we had been able to extend that over a wide front, or if we had taken full advantage of the invention and introduction of the tank in 1916. Immediately after the appearance of the tanks the infantry reported: 'we have to contend with an entirely new opponent. Our people will stand no longer. They lose their senses and run away. We have no means of defense against it.' But this cry of warning was unheeded. The damage done by the tank did not consist in the loss inflicted by its firing equipment and machinery; that was very slight, because its personnel could not aim accurately on account of the shaking of the tank and the limited field of view due to the narrow slits, but its effect on morale was calamitous; men felt themselves to be completely helpless against this *machine* which crawled upon them like a traditional monster, with crashing din, frequently surrounded by fog and dust, and against which their arms were impotent. At home they saw only pictures of destroyed tanks, heard only how the infantry had evaded its movements, and how we fought them with hand grenades and anti-tank guns. But the actual picture was mostly one of terror-inspired infantry fleeing in panic."

Hesse makes bitter complaint of the press service and the military publicity establishment. "Our press" he says, "did endless damage. How far it acted 'by Command' I do not know, and for that reason the reproach that I bring against it must be subject to qualifications. I will, however, adduce one instance justifying the bitterness against it in the front lines: on New Year's day, 1915, I wrote home: 'the papers contain only announcements of victories. We here actually saw very few signs of victory. We can only say that never before have we had to fight harder than during the weeks just passed!' Now it is too late to do better but we should at least learn this: *The speaking tube must be open.* Responsible quarters must of course know of the sounds that issue from it and follow every issue to its source and conclusion and keep it well in hand. Censorship can, in war time, never be dispensed with, otherwise military secrecy, which we need in order to be always at least one step ahead of the enemy, would suffer. But such a censorship needs men who know their vocation and can discriminate between what is important and only trivial. It is one of the most important functions of the press to direct attention to grievances and give initiative to their removal. War also gives us a second maxim: where truth is mightiest weeds will not grow nor remain healthy. A people will remain wholesome only when they see what is actually occurring and recognize errors in time but not when doped with illusions."

Hesse gives much emphasis to the greatest of all errors which, especially in the later period of the war had control, not only over the leadership but also over the entire home population, and contributed materially to the destruction of Germanism, and that was: *underestimation of the opponent.* The front, however, had an entirely

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different view. "There it was known what kind of an opponent we had imposed upon us with the American. This enemy had backbone and nerve, that must be said in his praise, but he also exhibited a brutal harshness. The Americans kill everything.' That was the exclamation of terror that lay in the bones of our men on July 15, 1918, for a long time, but at home there were only jests over the defective equipment and training of this new enemy and over the American bluff. But we left on the field, dead and wounded, more than 60% of the troops brought into the conflict on July 15, as a result of our encounter with this new enemy."

When it is asserted that this and that must not be made known to the troops for reasons of secrecy, and that on account of this the reaction of the common soldier was understandable. But when, on the other hand, it becomes notorious that secrecy from causes originating from staff sources is not fully guarded, suppression of harmless news becomes more than a mistake. A pertinent instance is extremely instructive and confirms a disclosure that was here (in Switzerland) also recognized as a cancerous evil. "In Charleville it was generally known, in the beginning of July, that an attack would be made by us on the Marne front." The culpability for this is attributable chiefly to the higher staff, which was unable to keep this preknowledge to itself. Too many clerks were initiated. The General Staff officer was only an order giving but not an executive officer. But when it is a question involving the lives of tens of thousands, not every one ought to have been made a confidant who, under the seal of secrecy or under the influence of a congenial bottle, sacrificed his honor. The carelessly handled operations of the telephone also contributed much in this direction. Of course use of the apparatus was shut off from the generality but it had to be made available for tactical communications. When, therefore, for example, it was indiscreetly ordered that "the supply of ammunition must be expedited or else we will not be ready at the time fixed," even an ordinarily intelligent enemy listening in, (and of such interceptions we had ample proof,) could arrive at a correct conclusion of the situation. The manner of carrying on conversations by telephone under such circumstances, is not a matter of indifference.

We have already alluded to the pernicous and fateful role of the nervous leader. It manifested itself plainly and notoriously in the merciless disregard of the plainest maxim for securing the readiness of the troop for the offensive: *failure to economize strength* at all times. With the Germans the failure in this respect must have been deplorable. Hesse writes: "The endurance capacity of the troops, particularly of the infantry, was used to the utmost, frequently when there was no necessity. What a mass of trench work it was required to perform, in total misconstruction of its proper function, from the Autumn of 1914 to the end of 1916. Trenches were lined with plaster and swept out every morning, scientifically planned drainage systems and concrete constructions, which were largely built to serve a pleasing

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appearance only, were constructed. While the infantryman forgot his most important part: how properly to use his rifle. He had, when the Frenchman made the attack on the Somme, lost the nerve to see him approach and knock him down as he came up. He threw out a few hand grenades but his rifle was left in the ditch. When the troop was relieved and brought to the rear not a week passed when there was not an inspection. Rest ought to have been the important thing when troops were relieved from the front lines.

Another point that indicated the general nervousness was precipitation in carrying out many military enterprises. Hesse cites this as the most prominent cause for the failure of July 15, 1918. He says: "Every fundamental action has *time* for a factor. Hostile action, unfavourable weather conditions and uncalculable difficulties must be considered. I believe it should not have been brought about (the attack of July 15) and the measures taken in its initiation were precipitate, when it was decided as indispensable to begin it at that instant of time. It was not possible for the infantry to secure the necessary information. During the war the intermediate commanders always misapprehended the time that was required to obtain information, and information was indespensably necessary in order to attain anything. Charts alone were not sufficient for practical undertakings."

It was a well admitted maxim that simple methods only gave promise of success. Hesse calls attention to the fact that no method can be sanctioned that requires that every order must necessarily be given only in writing, even when the utmost haste was called for. He cites numerous instances when the written orders arrived only after the troops ought to have been under way six hours before. Of course this was a cause of precipitate haste, the men were driven and nagged and often arrived an hour too soon. It was of course to be regretted that the leader in the front was opposed in principle to such a misconstruction of the phrase "at once" used in his report, when in issuing an order consequent to it, the haste caused suffering to the troops by depriving them of needed rest. Nervousness of leaders was conspicuous in such cases. In France at the times of the great hostile offensives in 1916, 1917, and 1918, the attacking troops were under a continuous system of baiting. If an attack was anticipated on the right the regiment was shifted to that side. It was then set in march for two or three hours. Frequently it received, while still under way or on arrival at the point designated, countermanding orders and—"right about, march, the enemy has attacked on the left. Utmost speed is required." The man serving at the front, who was then called out perhaps for the third time at night, exposed to wind and weather, and driven to haste to reach the 10 kilometer distant new position, became careless and took his time hoping to evade exertion because a counter order might possibly again arrive, but meanwhile the enemy had actually attacked and the defense arrived too late. But the fault was with the leadership that had lost its capacity for discriminate judgment and had become totally ignorant of matters on its own front.

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"The war of position brought with it another manifestation that was at first regarded as unimportant but later on made itself disagreeably felt: this was the interference of the higher commanders in the minutiae of the every day's work. Setting a picket post in an advance trench is the work of the company commander, not that of the general of division or even of the army commander. (I recall such a case). And when a desire was indicated for a change of position in the front lines on the basis of a prepared chart, it happened that the leader in the trenches utilized a rubber eraser and pencil, and did not carry out instructions as shown but acted according to his own judgment, that is he construed the order in such a way as to give him the best opportunity of evading its sense. This was done by subordinate troop commanders only too frequently, in later times, when orders were given that ran counter to war experience or required impossibilities from the troops. And why was all this possible? Simply because the commanders and their general staffs were not living (en rapport) with the troops but issued orders only and did not, when matters were becoming serious, assure themselves whether or not instructions were actually being carried out as written or in fact could not be so carried out."

Finally, a few remarks on tactical subjects: a method very frequently employed in the world war was the counter attack—retaking of a position lost to the defense in the first attack. "This had to an extent become almost an idolized system. When a position was lost we consoled ourselves that it would be readily recovered in a rushing counter attack." Even with us, in Switzerland, the counter attack was being absorbed as a praiseworthy universal nostrum. What is our author's judgment regarding it? "Did the people at home have any presentiment," he says, "that the most terrible part in a defensive action was in the greatest measure the counter attack? In it the troops were bled to the utmost limit, but this method of fighting tactics of attack had become the model. Of course the counter attack has its good points when there is fair promise of success. Such might be the case when the troops available for the attack were locally, in respect to number, at least, equal to those of the enemy and quickly available and at hand. But how could we ever have for immediate disposal for the attack a mass equal to that of the enemy? Usually and in most cases the counter attack came too late. The enemy had become nested in and his machine gun fire caused heavy losses in our ranks and our artillery fired at random. They could not have done otherwise because they had not been given time to obtain information." Later on an unsuccessful counter rush was replaced by a deliberately planned and prepared attack. But as a rule, even with this, the difficulties were misapprehended and too little time was given for the preliminary measures. "It is not sufficient when only two or three days are placed at one's disposal, because it is impossible to ascertain, without a possibility of doubt, the status of the enemy and the consequence was a terrible slaughter for the infantry. If a counter attack is to be

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successful, one must have abundance of time and assume that the enemy has prepared himself and must make one's own arrangements complete, from the bottom up. What that means cannot be sufficiently emphasized."

For real success the assured cooperation of the artillery with the infantry is one of the first demands, but in this respect there were many hitches because, our author writes: "Our experiences were many but the sad ones largely preponderated. Up to the Autumn of 1917, I recall only individual instances in which the cooperation was typical. Even later on the improvement was not material. I must, however, state, that the foot artillery had a better understanding of infantry situations than the field artillery. The fault lay with the peace training of the artillery and the utilization of its very earliest war experiences. Infantry and artillery usually operated side by side as if each was engaged with its separate enemy, that is to say, the infantry clamoured for the artillery and wanted it at places that were quite disagreeable for it, but the artillery kept on firing on targets 'more renumerative' in its estimation. When, finally, infantry regiments had their own escort batteries assigned to them—after three and one half years of war—things began to improve. But even that was insufficient assistance. Important as was the problem devolving upon artillery assembled under a single director in an artillery attack upon designated points in rear positions, of artillery in position, of villages and for other important purposes, it was still evident that effect of assembled artillery was without result when the infantry attack was checked in its first stages. From the very first actions in the war it became evident that the infantry must have the most intimate touch with the artillery, and that this was most satisfactorily accomplished when the artillery was subordinated to the infantry. If our wishes had been heeded the infantry would always have had at its disposal one heavy field howitzer battery and three light batteries. That this could not be well we knew and had to be content. But the more urgently was voiced the demand that the artillery should acquire an understanding of and assimilate the thought and feeling of the infantry, but that was not realized. What a length of time it did require before permanent observers of 'the sister arm' were at last stationed with the company commander in the firing trenches! The artillery always had as an excuse: we have a better outlook from the rear and see more. But it is to be regretted that they did not comprehend what an infinitely restful feeling it gave the infantryman, when he had at all times at hand a representative of the artillery arm to whom he could at once make known his desire for defensive fire when such was needed. Besides, it relieved the infantryman's mood of depression when he could feel that he was not alone there to be shot at; when he saw a man with the black stripe on his cap alongside of himself."

"One of the greatest surprises of the war was establishment of the very slight effect of artillery fire. Even the heavy calibers were effective only when direct hits were made. An exception to this was the

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high explosive shell of the new French field guns. It was our most dangerous enemy on the west front. It must be candidly admitted to the French that their artillery was, in respect to excellence of material as well as skill in the direction of its fire, unsurpassed by that of any other army. The Englishman was more cumbrous—plump—in his manner of firing. One could have walked around the point of impact of an English shell with reasonable assurance that every shot would strike approximately at the same point—to-day, to-morrow and the day after."

"We frequently, especially in the beginning, had a complete misconception of the 'rolling barrage' that went in advance of our infantry, believing that every thing in advance would be smashed flat. It was effective not on account of the hits it made, but because it enabled the closely following infantry to surprise the enemy, so that he could neither operate his machine guns nor leave his trenches."

And now a word relative to attack and defense : in that also Hesse's writings cover a rich field of reports and relations of experiences and observations, some of which are here presented : "The defender," he asserts, "can succeed, generally, with one third of the forces at the disposal of the attacker. A few months after the beginning of the war, when the French withdrew their forces from the Italian frontier, and the English had succeeded in placing their trained men in France, we were, in respect to numbers, at a disadvantage. Was it not then expedient, when the situation of our Austrian allies became so serious, to economize—husband—our strength? Whether or not we could carry the war on much longer was wholly dependent upon the timely institution of the war of position. But by so doing we deprived ourselves of the possibility of inflicting further serious damage upon our enemy, and so brought stagnation to our energies. The consequence was that the germ of that infection had time and opportunity to assert itself and operate to our eventual destruction. The turning point of the war was *October 1914 and not March 1918*, when we again assembled all our strength to decide the war in our favor. That the possibility for such an outcome existed cannot be denied. The West front was the only remaining field of combat because Russia, Serbia, Montenegro, Rumania and also Italy, were played out and we had a fair promise of success if we could take the initiative in a determined attack which, if it resulted favorably, would have revived our falling spirit at home and in the army. In attack only could we sustain the will to victory and soldiers endowed with that will can, even when otherwise weak, render extraordinary service. Under any other plan our front would have broke down in July, 1918, but—as it came about, the home front broke down and the army, unconquered, notwithstanding its defeats, had to surrender by order."

Hesse then describes the changes which the defence then underwent; how at first a rigidly defended front was considered as the only promise of success and how the defense later on became elastic; how extensions of depth were co-ordinated to the new conditions and thus became mobile but were in some instances congealed to a fixed design.

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This naturally had its results. The movable defense consisted in this: that the posts and groups stationed in front withdrew to an established main defensive as soon as the enemy's attack developed. The individual therefore, considered himself no longer under orders to hold his place at all hazards without question; the advanced posts were no longer condemned to sacrifice themselves. The individual himself was the judge of what should be done. At first this worked fairly well, but there came soon what was to be expected if one takes into account the psychology of the individual. He who, standing at a post in advance, had ever had experience of an attack by the enemy and had been lucky enough to reach safety from the front was richer by an important experience—he had discovered that one can save his life if he only turns his back to the enemy in time—and of course not all were heroes. This simple logic was speedily assimilated and was applied by many assigned to the principal front lines of defense. When the men from the extreme front posts came in and attempted to reach safety of the main defensive line they were followed, within a few hundred yards by the French or English, and slipping away rearward became general, the individual, seized by fear and recognizing a very simple way to save his life, dropped his arms and equipments and ran away. To this must be added an additional fact: a very great mistake was made when judgment of the situation was given over to the individual. He of course had to decide when he should leave his post. This error was bitterly avenged by its results. The troops, morally weakened and no longer holding tone, had learned to retreat and it would have required much time to bring them back to a sense of duty and for this there was no time. Thus the mobile method of German defense brought about our fate."

* * * * * *

But, in attack or defence, going in or merely holding out, the main thing for success was and continued to be, *a leader who had a purpose and took action*. The burden of the fight devolved always upon the infantry. Hesse says: "I speak not selfishly, when I assert that I leave to the other arms all that is coming to them, but the blood that flowed shows where the fight was heaviest."

With this I will close my remarks. The little pamphlet is replete with many more lessons and experiences and I would therefore lay emphasis on the study of the original, especially to-day when we also stand in the sign of remodeling and rearranging. The mistake we made is usually that we listen only to the higher leaders, give heed only to their experiences and ideas and refuse to hear the voice of the troop commander at the front. That must not occur, and would be bitterly avenged, as is so clearly set forth by Hesse; our watchword must be, test everything, even that which the officer and the man at the front knows how to report, and make the best your own and stick to it.

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ARTILLERY SURVEY.

BY COLONEL H. W. NEWCOME, C.M.G., D.S.O.

THOUGH the application of survey principles and methods to artillery work can hardly be called new and many officers have a general idea of its scope and aims, recent experience at practice camps shows that there is still a good deal of misconception on the subject; the importance of survey work to the artillery is underestimated and there is an exaggerated idea of its difficulties. The main objects of artillery survey are to locate hostile targets and to enable effective fire to be brought to bear on them without ranging or registration. The location of targets is the business of the sound-ranging and flash-spotting sections; the elimination of ranging is a question affecting every brigade and battery commander.

Surprise is generally recognised as one of the elements of success and the chief obstacle to artillery surprise has been the necessity for previous registration or ranging. If line and range can be accurately measured, allowance made for the error of moment, and the line accurately laid out, the first rounds from any gun should fall on or near the target, and the result will be surprise, with increased moral effect and chance of inflicting casualties before the enemy can disperse or take cover as well as a saving of time and ammunition. The preparations for opening fire will take rather longer than if the trails are dropped and ranging commenced at once, but in many cases effective fire will be obtained in a shorter time and without previous warning to the enemy. When a large force of artillery has been concentrated for a big attack the element of surprise is even more important, and ranging or registration cannot be allowed; the same applies to a turning force accompanied by artillery which is intended to surprise the enemy. In all these cases we have to turn to artillery survey methods in order to obtain the necessary accuracy at the start, even when the fire can afterwards be corrected by observation. But it will often happen that observation of fire is impossible owing to atmospheric conditions, dust, smoke, gas, etc. and then we shall be driven to predicted shooting; this will especially be the case when the guns are asked to neutralize the hostile batteries during the course of an infantry attack.

In a defensive position the location of our own batteries by the enemy is easiest when they are ranging or registering; anything which enables these processes to be cut down or cut out altogether tends to make location more difficult for the enemy. If we could deliver our fire mainly in the form of big bombardments, sudden short concentrations of several batteries, and

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harassing fire from temporary positions, it would be exceedingly difficult for the enemy to locate the battle positions of our batteries and therefore to neutralize them effectively during an attack. If however we are to operate in this way we must be able to work out line and range before fire is opened and lay out the line accurately. This is where survey methods help us.

When an accurate large scale map is available the solution of all these problems is comparatively easy. The situation we have to face is that in many possible theatres of war we cannot count on having such a map, or on being able to make one while the operations are in progress; if we wish to make use of predicted fire with its attendant advantages we must be able to do so without a map. Artillery survey methods provide for this because they are based mainly on trigonometrical points, that is to say on a comparatively small number of points whose positions have been fixed on a grid system. They may often be available when no maps are to be had because it is very much quicker and easier to fix the positions of a few points and issue these to batteries as a list of co-ordinates than to prepare and print a map. We may expect in fact that if no "trig points" are available at the start of a campaign it will be possible to fix enough of them long before a map could be got out. From these points the positions of our guns and their targets can be deduced and the lines of fire laid out, the accuracy attainable being much greater than anything which can be reached by methods depending solely on a 1; 20,000 or similar map. At home accurate large scale maps are usually available and the country abounds in features of all sorts, so there is a tendency to rely too much on the map and to underestimate the importance of methods for which no map is necessary. In India where there are, with few exceptions, no large scale squared maps and the tactical maps are of too small a scale to admit of more than rough indication of targets to the artillery, the question has received more consideration. It has been found that by employing an "Artillery Chart", which is essentially a plain grid on which trig points battery positions and targets are plotted as soon as they have been fixed, a brigade commander can direct the fire of his batteries with speed and precision upon any selected target. provided the rate of movement has not the celerity of a pursuit. To get the full value from such a system requires close co-operation between units of the various arms, a certain amount of survey training all round, and efficient means of intercommunication. Given these things, an artillery chart will be extremely useful to all arms as a basis of co-operation between them, but full value cannot be got from it unless all concerned have the survey knowledge necessary to make the best use of the time available.

There are some who are inclined to doubt the advantages of these methods because they think they are too slow or too complicated to be useful in moving warfare where the time for coming into action is limited. An officer who knows and has practised survey methods will almost always succeed in laying out a much more accurate line in any

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given time, however short, than one who has not; even if he does take a little longer in opening fire, the extra time required for the preliminary work will generally be well spent if he can ensure getting his guns in the correct line from the start. Nor must it be supposed that this preliminary work is very difficult or that it requires great mathematical knowledge. Putting aside the questions of sound-ranging and flash-spotting which concern more directly the counter-battery staff, the work of the artillery surveyor consists in :—

(a) Fixing the position of his own battery.

(b) Working out the range and bearing of the target.

(c) Laying out the line of fire.

Of these (a) should be done either with a plane table or by measuring tape and director; (b) can be done by calculation from co-ordinates, using logarithm tables and slide rule, and checked on an artillery board; (c) can usually best be done with the aid of a bearing picket established by the brigade staff or by the survey company while the batteries are getting into position.

The time taken over all these processes depends on the nature of the country and the number of trig points available. The choice of position also may greatly effect the time required to open fire. It is not therefore sufficient to have a few trained officers and men in each battery who know something about survey; brigade and battery commanders must know enough about it to understand clearly how their choice of positions will affect the time required in preparation and to what extent survey considerations must affect their choice. In ordinary open country if the position is well chosen and if each man knows exactly what to do and how to do it without a mistake, a brigade should be able to put down accurate fire on a selected target in half an hour from the time of coming into action without any previous registration.

Survey work is not a special branch which only concerns a few junior officers of the theoretrical and book-worm type; it has an immediate and practical bearing on almost all artillery work which no fighting soldier can afford to neglect. We have assumed the responsibility for carrying out all the survey work required for our own purposes; it is the senior officers particularly who must study the question and realize what this responsibility implies.

The present situation in its general lines may be summed up thus :

(a) The ability to make use of predicted fire is calculated to confer important tactical advantages on those who possess it, even when fire can be corrected by observation.

(b) We cannot count on being able to base our methods of predicted shooting on maps alone.

(c) Adequate training in survey enables us to be independent of the map.

(d) If this training is confined to a small number of officers and men, much time will be lost in the field as it will be impossible

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to divide up the work to be done: the various processes will have to be done in succession by experts instead of concurrently by all.

In position warfare no doubt we could carry on as we did in France with the help of a few experts; in moving warfare this is not possible, as the time available for preparation will be too short. If we wish to gain the tactical and technical advantages derived from survey methods it is absolutely essential that a large proportion of the officers and men of the Regiment should have been trained in them. This problem can only be solved if all officers are prepared to give time and attention to the subject.

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A FIELD ARTILLERY GROUP IN THE GENERAL ADVANCE.

BY COLONEL W. H. F. WEBER, C.M.G., D.S.O.

Continued from page 322, Journal of the Royal Artillery, October, 1922.

PART II.

THE WAR OF MOVEMENT AT LAST!

CHAPTER I.—OCTOBER 5/7. (See Map No. 2.)

October 5th found 2nd Bde.[1] on the move again after a pleasant little holiday; we were to go further North this time, via Bellenglise. The nature of the fighting was expected to, and did, more nearly approach open warfare. Before marching, the Bde. Commander summed up September lessons, such as were likely to be applicable to October, as follows :—

Support of Infantry and Economy of Force.

(i) 4 guns in action and 2 in reserve (probably with forward wagon-line).
(ii) Not more than 1/3 of guns on move at same time.
(iii) Might be necessary to keep firing-battery wagons with guns in action.
(iv) IX. Corps Instructions contemplated possible exclusion of organised barrages in future.

Choice of positions and observation.

(v) Avoid banks or hedges marked on map or specially visible to the eye.
(vi) Avoid "Column of Route" during advance in battle.
(vii) Report *immediately* occupation of a new position.
(viii) Achieve efficiency without delay after occupation.
(ix) Probably have to shoot without help of the squared maps, with which we had been "spoilt" for years.

Reports and Reconnaissance.

(x) Every unit in Army responsible for touch with neighbours.
(xi) Patrols required for (a) Protection, (b) Information, (c) Reconnaissance of ground.
(xii) Pass back information gained, personally if possible.
(xiii) Drill of Operation Messages.
(xiv) Great demand for mounted men (out-riders) with a battery.

[1] Adjutants had changed owing to an officer's promotion.

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Communications.

(xv) Economise wire for special occasions.
(xvi) Lamp better than flags for visual.
(xvii) Wireless.

General.

(xviii) Constant testing of sights.
(xix) Treatment of ammunition in changeable Autumn weather.
(xx) Be prepared to man captured guns.
(xxi) 6-inch T.M's. will probably be affiliated to 2nd Bde.
(xxii) Splitting up of Bde. Staff to be avoided *if possible*.
(xxiii) Bde. Commander usually with Infantry Bde.; if not, with one (named) battery.
(xxiv) Great Principle—Take care of sights and ammunition, and *Fight by Eye*.

On the evening of 5th, we found 46th Division in high fettle over their recent success. They say "everything comes to him who waits"; this Division had waited since February 1915, for a sensational success.

In view of the prevailing ideas as to employment of 2nd Bde., R.F.A., in the forthcoming attack, a large number of officers were engaged on 6th in reconnoitring[1] the country from the high ground S.W. of Ramicourt as centre. Information was still uncertain as to who held Sequehart and Montbrehain. The enemy held Mannequin Hill, N.E. of Sequehart. Doon Copse was the highest feature in our area and there appeared to be a fine position for artillery along the Western slopes of the ridge Doon Copse—Mericourt, which could be modified to the ridge Doon Copse—Mannequin Hill. Once more, much would depend on the success of the French on our right about Sequehart. Two areas needed a watchful eye on the part of battery commanders, (i) high ground S.E. of Sequehart, (ii) that N.E. of Brancourt.

On the afternoon of 6th, it was notified that 2nd Bde., R.F.A., would be "in readiness" at the commencement of the attack, a detachment to move into action between Ramicourt and Doon Copse when the First Objective had been captured—remainder of Bde. to act according to circumstances.

Preliminary Instructions issued at 11.25 hrs. on 7th notified the place of assembly (Position No. 7) of 2nd Bde., R.F.A., as follows:—"Bde. Commander and O.C. 42nd Battery with O.C. section 87th Hows., (at a named locality) E. of Magny-la-Fosse; Batteries near Fosse Wood." Time of assembly depended upon a question of water supply, but midnight 7/8 at latest. Probable first position of Bde. would be in I 13, approx. 2000 ⅔ S.W. of Doon Copse with headquarters alongside 16th Inf. Bde. at Preselles. Advance to be in 3 echelons, viz: (i) 4 guns and 4 wagons, (ii) 2 guns and 2 wagons, (iii) first-line wagons. Route of advance as reconnoitred yesterday, if possible by the valley S. of Preselles; special care in crossing the Lehaucourt Ridge.

[1] Some excellent reports were rendered and the German line well established in our minds.

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Liaison duties were forecasted. Firing battery wagons to dump at once after occupation of advanced positions, then to return and refill from D.A.C. Section about Fosse Wood; First-line wagons on arrival to remain on gun positions. Water would be a difficulty; petrol tins required. 24th Bde., R.F.A. would be with 71st Inf. Bde., assembling S. of Joncourt, moving between Ramicourt and Preselles, and taking up a position on our left (North).

The Operation Order issued later explained that 16th Infantry Bde. was to attack on the right, with its outer (right) flank covered by a special detachment of 18th Infantry Bde. provided with tanks. 16th Infantry Bde. attack to be exploited according to circumstances. 42nd Battery (with one section 87th Hows.[1]) was to advance directly the First Objective was captured to a position about I 13 b 8/1, to act in immediate touch with the infantry on the spot, communicating with 2nd Bde., R.F.A., by visual and orderly. The protective barrage, over whatever line was eventually occupied by the exploiting infantry, would be 42nd on right, 21st on left, 53rd and 87th superimposed. 1/K.S.L.I. would capture First Objective; 1/Buffs would advance through 1/K.S.L.I. (liaison 21st Battery); 2/York & Lancaster would attack Mericourt from N.W. (liaison 53rd Battery).

Note on Chapter 1.—The position down South was uncertain, the French having met with strong resistance W. of St. Quentin. The French were faced with a difficult task; their objectives were such that, even in case of their success, our (6th Div.) frontage would be thrown back from left to right and 7,500ˣ in extent; it might be 10,000ˣ; and the French to start an hour later than we did. The valley between us and them was to be the scene of operations of the special detachment 18th Inf. Bde. with its tanks. A detachment of 46th Div. (left unrelieved at Sequehart) had to undertake a subsidiary attack[2] before our zero. On our left, 30th American Division (who had relieved the Australians) was ahead of 6th Div. (who had relieved 46th Div.), thereby complicating the barrage. The force of Field Artillery supporting 6th Div. totalled *eleven* Bdes., of which only 7 were to take part in the creeping barrage. 5th Cavalry Bde. was in attendance, and, as before, Life Guards' Machine Gun Battalion was attached to 6th Div.

The above Note seems necessary, properly to understand the course of events. It is obvious therefrom that we were in for something different to the normal frontal attack of 1916/17 with its parallel lines, wired and entrenched, and its limited objectives.

CHAPTER II.

Oct. 8/10. (See Map No. 2.)

NOTE.—The writer finds it difficult to describe the exact course of events (from the point of view of the Right Group) during the next period, as almost all information came in personally and many orders were given verbally. He has, however, NOT drawn on his imagination.

[1] At special request of O.C. 2nd Bde., R.F.A.

[2] Unfortunately this subsidiary attack failed, twice over, but the great effort made enabled 6th Div. troops to cut the defenders off and compel them to surrender.

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At 08.15 hrs. on 8th, batteries sent forward their R.O's to I 13 area. At 08.30 hrs. 42nd Battery and attached section 87th Hows. were ordered forward according to plan, and passed through at 08.42. At 09.40 we received news of the capture of Cerise Wood by the French, which turned out to be inaccurate, for a subaltern of 21st Battery, sent on reconnaissance at 13.00 hrs., brought the first news that things were going better on that flank. Three other officers went out at various times between 11.00 and 15.00 hrs., all bringing back useful reports to the Bde. Commander, which were of course passed to 16th Inf. Bde. At length the special detachment 18th Inf. Bde. (1/West Yorks) secured Mannequin Wood, in spite of all three supporting whippet-tanks having been knocked out; the rest of 2nd Bde., R.F.A., was launched at 16.15 hrs., and at 17.00 hrs. headquarters 16th Inf. Bde. and 2nd Bde., R.F.A., shifted to Preselles Farm (Position No. 8).

42nd Battery had had some sensational shooting during the day, but unfortunately the battery commander was severely wounded by a rifle bullet and the battlefield knew him no more.

6th Div. had gained its final objectives by dark, including Mericourt; there had fallen into its hands over 30 officers and 1,100 men; casualties had been moderate, coming chiefly from the right flank previous to the capture of Mannequin Wood (the decisive incident) and the French success; 71st Inf. Bde. and 5th Cavalry Bde., on our left, had come under fire of German field-guns firing over open sights from about Jonnecourt Farm.

Followed an indescribably hard night! Communication to be established; Night-lines to be decided and notified (eventually Orme Copse—L'Esperance—then directly towards Brancourt); 2nd Bde., R.F.A. to be reinforced to form a large Group; "remaining efficiency" (1.) of the various units to be studied; and orders to be issued for an attack under a barrage at dawn. It was pitch dark and the accommodation at Preselles bad (after our shelling), but there was a dug-out.

The Right Group was at first increased only by 5th Army Bde., R.F.A., but later by 23rd Army Bde. also. Somehow or other, orders were prepared and issued (verbally, for the most part); somehow or other, 16th Inf. Bde. handed over ground on its right to 46th Div. and side-slipped to the left (N.); and somehow or other, we attacked at 05.30 hrs. on 9th under a respectable barrage. The attack, whose object was to complete capture of the "area of exploitation", met with considerable success.

At 06.10 hrs. on 9th, it was notified to all concerned that 16th Inf. Bde. was to reach and hold a road leading approximately from Jonnecourt Farm to Beauregard and to form a defensive flank facing Fresnoy-le-Grand; then, while maintaining the defensive flank. 6th Div. was to gain the Fresnoy—Bohain railway line.

At 08.00 B.G.C. 16th Inf. Bde. unexpectedly[1] moved. The Group Commander, having lost his infantry brigadier, experienced delay in meeting unit representatives at the appointed place (Doon

[1] Without telling the artillery.

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Copse), but eventually the Group disposed itself to meet existing circumstances, as shown on the map (Position No. 9); it might have to fire E. or S.[1] Touch was regained with headquarters 16th Inf. Bde. in the afternoon and we settled down together in Doon Mill. Some registration had been done by the artillery, but in view of the fact that our patrols and those of 46th Div. on our right were 'out,' it was not possible to do the harassing fire ordered and arranged. It had been a hard but interesting day without any sensational events after the affair of the morning. The ground traversed was covered with dead, dispersed in open-warfare fashion, mostly German. Night-lines had been ordained running from N. outskirts of Fresnoy and along E. side of the railway, but the success of 46th Div., who occupied Fresnoy before night, altered things—and during the night 9/10 6th Div. entered Bohain.

Very late on the evening 9th, an order arrived grouping the division into 3 mobile mixed brigades, 2nd Bde., R.F.A., being affiliated with 16th Inf. Bde. 5th and 23rd Army Bdes., R.F.A. had left the Right Group during the later hours of the afternoon. As 16th Inf. Bde. was relieved by 71st Inf. Bde. during the night and went out to rest, O.C. 2nd Bde., R.F.A. determined to accompany them (in accordance, as he thought, with the spirit of the new grouping order) and took his batteries to Ramicourt early on 10th. This was apparently not intended and considered '*ultra vires*'; we had to suffer for it by a very early start on 11th. In future, a Brigade, R.F.A., though affiliated to an infantry brigade in the second, or even third, line, was to remain in its forward position and watch developments. (2.) Anyhow, Ramicourt was a fairly well-preserved village—much better than anything we had seen for a long, long time—and the pleasure of spending an afternoon and part of a night under such conditions compensated for a certain coolness towards us on the part of superior authority.

Here we can pause, after our first bout of something like open warfare.

Comments on Chapter II.—(1.) The "table of remaining efficiency" at about 21.00 hrs. on 8th read as follows :—

No.	Question.	6th Army Bde.	23rd Army Bde.	21st Battery	42nd Battery	53rd Battery	87th (How.) Battery
1	Number of guns in action?	13	Not yet reported to Right Group.	6	6	6	6
2	Ammunition—(a) echelons	Full		Full	Full	Full	Full (except 1 Section)
	(b) dumped on position	Over 200		None yet	309	200	208
3	Observation?	Not yet selected		Local	Local	Local	Local
4	Has battery shot itself in?	Not yet		Yes	Yes	Yes	Yes
5	Casualties?	None		None	B.C. and 2 Gunners	None	
6	Any shelling going on? ...	A little		Yes, on O.P.	Slight	A little	Quiet
7	Horses at?	—		—	—	—	—

[1] When 46th Div. had occupied Fresnoy, the southern line of fire was, of course, eliminated.

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(2.) Possibly an opportunity was missed to give a third of the artillery some rest; but it must be remembered that each minor operation was supported by the *whole* artillery, and that minor operations were occurring freely and at short notice. The point is, that the artillery needs its breathing spaces as much as the infantry.

CHAPTER III. Oct. 11/16. (See Maps No. 2 and 3).

2nd Bde. left Ramicourt at 03.45 hrs. on 11th and came into action "in observation" soon after 06.00 hrs., just S.W. of Bohain (Position No. 10). Bde. Headquarters established itself in the outskirts of the town,[1] which contained almost its normal inhabitants, so far as we could judge. Liaison was established with 71st Infantry Bde., at the moment the "brigade in the Line", and the day was spent in reconnaissance for positions to suit action contemplated for 12th. At dusk batteries moved their guns on to the selected positions N.E. of Bohain (Position No. 11), but only a few men passed the night there. 18th Infantry Bde. relieved 71st Inf. Bde. in "the Line", 24th Bde., R.F.A. taking up duty accordingly.

On the morning of 12th, Bde. Headquarters moved (early) to a small farm-house about 1 mile N.E. of Bohain; routes of approach to the new positions were chosen, which would avoid passage through the town; the ammunition dump was completed to meet the latest instructions; batteries registered (on *targets other than their barrage objectives*); operation orders and barrage tables were issued.

The position was as follows. The Americans held Vaux Andigny on our left and were considerably ahead of 6th Div. 71st Inf. Bde., in spite of tank support, had failed to reach the alignment on 11th. 46th Div. was held up by Riqueval Wood on our right and were still further behind. The object of to-day's minor operation (by 6th & 46th Divs.) was to come into line with the Americans; the special objective 6th Div. (18th Inf. Bde.) was a footing on Bellevue Ridge.

The attack took place at 16.30 hrs. in heavy rain. Except for some success on the extreme left, by 2/D.L.I., it failed all along the line. It was useful, for it disclosed a new enemy position, provided with a considerable amount of wire; it showed also that our maps were, for once, rather inaccurate. The opening of our barrage produced an unexpectedly heavy retaliation on the battery positions and caused a number of casualties, in which Bde. Headquarters shared.[2] It was evident that the enemy intended to stand along the Selle River.

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[1] Whence it was brusquely ejected after a couple of hours by "four two's."

[2] The brigade commander had an old Irish hunter, of marked personality—like most Crackenthorpe stock. He had apparently been very lame for weeks past; vets had advised his destruction, but he was a favourite; the brigade orderly officer had maintained that the horse was "swinging it." On this occasion a shell burst in the brigade staff lines; the animal in question, *very* slightly wounded, broke loose and led the lot off on a trotting tour. Pausing to graze, he was easily caught with the aid of a feed-tin, but it took the whole afternoon to recapture the others. Our friend never went lame again from that day to this, when he still carries his mistress to hounds.

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The next days were spent in constant conferences and reconnaissance; in addition to the normal harassing, and so on, batteries had to cut wire on 13th, in view of a probable renewal of the attack on a large scale on 15th; but late in the evening (13th), a temporarily defensive attitude was ordained. Tactically, a special condition was present, comparable to that of 29th September; we were very close up to the front line, and the position on our right (S.) flank was uncertain and that flank refused.

A new commander[1] had arrived on 11th for 42nd Battery. Life was rendered more pleasant during this lull by the existence of a fine crop of vegetables considerately grown for us during the summer by the enemy.

On 14th, a new plan was explained to eight field artillery brigade commanders. The Bellevue Ridge was to be attacked in enfilade from N.W.—entailing a preliminary flank move, surely a sign that the war of position was over. 6th Div. was to effect penetration from Vaux Andigny, 1st Div. to exploit. The attack was to be made under a barrage of eight brigades R.F.A. and eighty machine guns, and to be supported by 172 60-prs. and heavy howitzers. 2nd Bde., R.F.A., was to be the nucleus of the Right Group of 4 Bdes., R.F.A. (2, 5, 161, 298). 6th Div. infantry had to commence their attack on a frontage of 1500$^{\underline{x}}$, which (in the course of an advance of less than 3000$^{\underline{x}}$) extended to 5000$^{\underline{x}}$; there were several enemy strong-points in this fan-shaped area.

The problem was not too simple, either, for the Field Artillery. The area allotted the Right Group (Position No. 12) was an exceptionally difficult one in which to emplace so many batteries; it was chiefly occupied by scrubby woodland, of most uneven terrain, called Bois de Busigny and for the most part on a forward slope. The opening lines of No. 1 Barrage were, in some instances, at a range of under 2000$^{\underline{x}}$ (without registration) (1.), the final lines at an almost prohibitively long distance. Two of the four brigades had to move, after capture of the First Objective, in order to cover the forming-up of 1st Div. infantry by No. 2 Barrage. The other two had to move later (on capture of the Second Objective) to take part in No. 3 Barrage to cover the advance of 1st Div. This arrangement was modified; the moves were now to be by time-table, subject to orders from the Group Commander, and *trusting to their own patrols for security*. It was, of course, necessary yet once again to split up 2nd Brigade, R.F.A. staff;[2] for the Group Commander would have at least 4 brigades under him—in a battle of movement, too.

Within the Group, the barrage of 2nd and 5th (Army) Bdes. were to be superimposed on one another; similarly 161st and 298th Bdes. on the left (Northern) half; each Bde. to keep a battery ready to answer zone calls. The moves were to be by one battery per brigade

[1] Formerly staff-captain 6th D.A., so no stranger. This officer acted as O.C. 2nd Bde. R.F.A., during most of the remaining period covered by this narrative.

[2] 2nd Brigade sub-group was remarkably well handled during period Oct. 17/20.

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first; remainders of brigades to follow on successful occupation by of advanced position by the first battery; units behind to keep touch with those gone forward. Group Headquarters to be at Becquigny from 15.00 hrs. on 16th; communication after the start of the battle entirely by mounted orderlies. Wagons to dump on new positions, return to refill, and be replaced by First Line Wagons which would refill in their turn. There were amendments to the arrangements (arriving up to the last moments) so frequent and so complicated, that in order to simplify this narrative further details as to the Group Task have been omitted, but the writer does not remember an occasion which necessitated more meticulous attention to the requirements of superior authority or more care on the part of battery commanders.

Another serious, and avoidable complication was the decision at a late hour (on 16th) of our Infantry Brigadier to change his battle headquarters (2.); the artillery communications had all been laid; nor did the brigadier in question inform his artillery of the change. The result thereof was felt throughout the whole two days fighting, and must have been serious had the attack failed, as it at one time threatened to do, or the enemy been active.

At the last, the Right Group was ordered to emplace a single section[1] to enfilade the enemy opposite 46th Div. on our right. (3.) Its target was a length of enemy trench just W. of Regnicourt.

Careful arrangements were necessary to ensure that the old front was covered during the emplacement of the Right Group for the new battle.

The night 16/17 at Becquigny was saddened by the serious wounding near Group Headquarters of the B.G.C. 16th Inf. Bde., who lost his arm. 2nd Bde., R.F.A., was not working with him on this occasion, but had been in almost constant liaison with him since the Autumn of 1917; he was always sympathetic in his dealings with the Gunners and we missed him very much.

Comments on Chapter III. (1.) At this period of the war, preliminary registration never took place as such; the practice of firing unregistered barrages had been initiated at Cambrai in November 1917.

(2.) Without wishing to insist too much, the change of plans here recorded was the most inconvenient instance in the writer's experience of the "headquarters" difficulty. The new Infantry Brigade Headquarters were 1½ miles from those originally fixed and rather inaccessible. The change was made so that the 6th Div. Brigadier could be alongside the 1st Div. Brigadiers, the importance of which is not for a moment underrated.

(3.) This was the third occasion in the writer's experience on which he was asked to perform an enfilade task. Enfilade artillery fire reads better on paper than it works out in practice. On the whole it would seem to be best carried out by a detachment of the formation

[1] The task was duly performed but the position chosen turned out to be in a very hot spot. The section commander was most unfortunately killed, for he was a particularly able officer, and there were a number of other casualties.

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which requires it; the task is not easy (from a gunnery point of view often quite difficult), accidents can easily happen, and any consequent unpleasantness is best kept within one Formation. Secondly, it is more suitable to offensive than to defensive conditions, because an outlying detachment is difficult to control, and control is usually easier to maintain in the attack than on defence, unless the enemy is very active.

CHAPTER IV. Oct. 17/20. (See Map No. 3.)

At 05.20 hrs. on 17th the attack was launched, in thick fog. At a time not recorded[1] in any papers at disposal, information was considered good enough to advance 21st Battery of 2nd Bde., R.F.A. together with one battery 298th Bde. to the valley running due South from Vaux Andigny and lying at the foot of the Bellevue Ridge (Position No. 13). At 08.20 the rest of these two Bdes. was ordered forward to join their advanced batteries. Group headquarters, which after the start of the barrage had been located on the railway embankment between Becquigny and Vaux Andigny, moved later to the above-mentioned valley. It was a rare and exhilarating sight to watch the long lines of guns trotting down the slope into action in the open. On arrival in the valley, the Group Commander was soon able, on a pre-arranged plan, to connect up by telephone with 6th D.A.—not a bad performance on the part of 2nd Bde. Signal Officer. (1.)

Things had not gone perfectly with the infantry. The assembly of 18th Inf. Bde. just outside Vaux Andigny, and the passage of supports through the village, had been seriously interfered with by enemy gas shells. In spite of tapes laid out to show the initial lines of advance—which, it will be remembered, was fan-shaped—direction was lost. 16th Inf. Bde. (on the left) got its objective without delay, except on its extreme right; but 18th Inf. Bde. in the low ground (one of whose battalions actually advanced arm-in-arm, the better to ensure direction) became involved in the fog with 46th Div. troops on their right. It was the advance of 1st Div. which definitely secured the First Objective all along the line, while troops of 1st, 6th, and 46 Divs. met in Andigny-les-Rermes (in 46th Div. area).

It may be asked whether it was really safe to advance the batteries under such conditions, but at this period of the war no one took counsel of his fears, and enough information was brought in personally by selected F.I.O's., or forwarded by liaison officers with the infantry, to satisfy the Group Commander that *advance was justifiable, if the batteries used patrols properly.* The F.I.O's accurately located advanced positions of 16th Inf. Bde., 46th Div., and the French; but immediately in front of us, the position was uncertain.

At 09.50 hrs. the Group Commander ordered forward the 5th Army and 161st Bdes., R.F.A., to the Bois St. Pierre-Pres Des Vaux

[1] The exact positions and moves on Oct. 17 of the various units in this large group are found most difficult to follow in the available records. Map No. 3 shows only those which the writer can be certain of

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valley on the other side of the Bellevue Ridge (Position No. 14), to fire No. 3 Barrage (due to last till 12.52 hrs.). At 10.37 hrs. 2nd and 298th commenced their No. 2 Barrage, after the completion of which (up to the limit of their range)[1] 23rd Army Bde., R.F.A., which was by now in the valley W 26, came under the Right Group Commander. As two Heavy Artillery representatives were, about this time, offering their services and asking for information, which the Group Commander was able to give in considerable detail, there were at this moment under his leadership between 120 and 130 guns—and it was a "moment of movement." Group Headquarters established itself in the Southern outskirts of Vaux Andigny, at a spot where no projectiles were falling.

There was now a pause in the battle; 6th Div. infantry were being gradually eliminated; 1st Div. had taken over command, but the C.R.A. 6th Div. remained on duty. The time was occupied by Group Headquarters in gathering and sifting information from various sources, and by the batteries in improving their positions and in management of ammunition. This information, in unusual detail, showed 1st Div. infantry as held up on a line along the Eastern edge of La Vallée Mulâtre and the W. edge of Andigny Forest. The last report, particularly clear, was brought in personally by a captain, formerly adjutant 2nd Bde., R.F.A., at about 16.00 hrs.

There now occurred an incident, of interest as showing what may occur on such occasions; it was entirely *due to the separation of infantry and artillery headquarters.* At 16.25 hrs. a message, considerably mutilated, was received over the 'phone from the C.R.A. 6th Div., ordering the Group to fire a barrage to cover a renewed attack by 1st Div. Infantry; the barrage was to start at 17.15 hrs. from a line about one thousand yards distant from that on which the Group Commander believed that infantry to be held up. The Group Commander, on receiving the (mutilated) message, sent for the (five) Sub-group Commanders, and went at once to the telephone; but at this critical moment it had gone 'dis.' He sent two officers in succession to 1st Div. Infantry Brigadiers' headquarters; the first to ask whether the line of resistance as known to Group Headquarters, vide 16.00 hrs. report, suited 1st Div. for the first line of the barrage; the second to ask simply when and where the barrage was to begin. Both officers were long delayed at the infantry headquarters, but returned with the following answers, (i) that 1st Div. infantry line had changed somewhat since that given in the 16.00 hrs. report and quoted by the Group Commander, (ii) that 1st Div. Artillery was firing the barrage and that nothing was known of our Right Croup co-operating. Information to be gathered by the Group Commander from his immediate neighbourhood was conflicting beyond hope of usefulness. It was now past 17.00 hrs. and impossible to fire the barrage as ordered in the (mutilated) message; but a long 'concentration' was put down on absolutely

[1] Eighteen-pounder batteries of 2nd Bde. moved forward after reaching their range-limit to Position No. 14.

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'safe' localities at 17.15 hrs., at which hour some kind of action could be heard to occur. At 17.24 hrs. arrived written orders confirming the (mutilated) message; and about the same time two F.I.O's rendered reports showing the modification to the 1st Div. infantry-line since the 16.00 hrs. report, thus confirming the answer sent from 1st Div. infantry headquarters. This incident, itself of little practical importance, has been narrated at some length because it illustrates very well the situations which come to an artillery commander in moving warfare; above all he should be at Infantry Headquarters. One sees here the problem, such as it was, and the action taken; in the cool reflection of to-day, the proper solution was (i) to issue instructions for barrage in accordance with the (mutilated) telephone message, (ii) to order the barrage not to be actually fired without further confirmation from Group Headquarters, (iii) *then*, to leave someone else in temporary charge, ride at once to 1st Div. Infantry Headquarters, and obtain their wishes personally? But "it is easy to be wise, etc." (2.)

As a matter of fact, the line was little different at dark from that given in the 16.00 hrs. report. We knew that 46th Div. were safely established about Andigny-les-Fermes and that the French were close up to Mennevret. The Right Group was reduced by the departure of 23rd Army Bde. before midnight to 2nd, 5th (Army), and 161st Bdes., R.F.A., and was to act as a stand-by to 1st D.A. 6th Div. Infantry were gone. It had been a vastly interesting day!

At 09.30 hrs. on 18th orders were received, still from 6th D.A., for a barrage to commence at 11.30 hrs. This barrage was duly fired; the attack was everywhere successful; the French got Mennevret, the (British) 1st Div. Wassigny, and the Americans Ribeauville. Immediately afterwards, 2nd Bde., R.F.A. and part of 5th (Army) Bde. advanced to the neighbourhood of La Vallée Mulâtre (Position No. 15).

On 19th, 6th D.A. Headquarters were eliminated and our Group came under 1st D.A., who gave orders for the advance of 2nd and 5th (Army) Bdes., R.F.A., to positions whence to cover the crossing of the Oise Canal; 161st Bde., R.F.A. was kept "in readiness." Group Headquarters was moving to Wassigny when a message was received from 6th D.A. that 2nd Bde., R.F.A., was to pull out and rejoin 6th Div.; this was not agreed to by 1st D.A. who were on the spot. The arrival of the message had caused Group Headquarters to remain in Vaux Andigny (where by now Headquarters 1st D.A. had established themselves); by a mischance, the (verbal) orders to 2nd and 5th (Army) Bdes., R.F.A. had miscarried (3.); so no one moved though Position No. 16 had been reconnoitred. It was luckily of no importance that the orders had miscarried, for an immediate crossing of the Oise Canal was not contemplated; and early next morning 5th Army Bde. joined 1st D.A., while, by 14.00 hrs. on 20th, 2nd Bde. R.F.A., was in IX Corps Reserve on its way to Becquigny. The battle line was at this moment, Oisy (French)—La Laurette—Reget (American).

Comments on Chapter IV. (1.) It would seem that if a unit advances in a battle of this nature, responsibility for touch between it

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and superior authority behind should be maintained from back to front. There was really insufficient personnel to lay and maintain communications within such a large Group after Group Headquarters had once advanced, though the utmost economy was observed. The mounted orderlies, too, were still unused to their new work.

(2.) The conditions under which a soldier may disobey an order are (a) that he must believe himself to have such information as to enable him to appreciate the situation better than the issuer of the order can do; (b) that he cannot refer to the issuer at the moment, but that he must inform the latter at the earliest possible moment that the order has not been carried out; (c) that he must bear the responsibility for non-compliance. All these conditions were of course fulfilled in this instance; and it must be remembered that the original message was considerably mutilated. It has three times happened in the writer's experience that a battle-order has arrived which it seemed to the recipient should not be carried out; on the first occasion it was clearly impossible to do so owing to fresh conditions; on the second occasion the recipient was admitted by the issuer to have acted correctly; on this, third, occasion, the recipient was probably wrong—a solution to the problem has been already suggested.

(3.) There is surely no more fruitful source of trouble than verbal orders! It was perhaps the personality of two officers, hitherto unknown to one another, which brought about this miscarriage of orders; one must be thankful that the occasion was not more important. If the man who is carrying the verbal order has time to transmit it to paper (in his own interest), so has the issuer time to write the order. Indeed, with many personalities, it takes less time to write than to dictate an order, and their written orders are the best.

CHAPTER V.—Oct. 21/Armistice. (See Map No. 4.)

NOTE.—The following pages are based on a written record: the author of this article was called away on urgent private affairs and was therefore, unfortunately, not present during these, the last, actions of the war in which 2nd Bde., R.F.A. participated.

The evening of Oct. 20th, found 2nd Bde. at rest in Becquigny, where we had a new and rather unexpected experience: for war had not passed through the country since Autumn 1914, and some inhabitants resented its inconveniences—not so much the shells, of which they said philosophically "C'est la guerre", but rather that four years of warfare had taught all armies to get the greatest possible value out of any luxuries available—arm-chairs, for example.

On Oct. 22nd the Bde. Commander went on leave; on Oct. 23rd, 2nd Bde., R.F.A., was called upon (unexpectedly) to relieve artillery of 4th Australian Div. The positions were S. and W. of Bazuel, headquarters in Le Cateau (Position No. 17); batteries were at the call of 24th Bde., R.F.A. A barrage was fired at 00.30 hrs. on Oct. 24th and the following night 2nd Bde. moved to positions N.E. of Bazuel

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(Position No. 18). On Oct. 30th it participated in a successful minor operation W. of Landrecies. There was a lot of 'harassing' on both sides during this period and batteries had rather a bad time.

On Oct. 31st, 2nd Bde., R.F.A., became part of a Sub-group under O.C. 16th Bde., R.H.A., the Group Commander being C.R.A. 4th Austr. D.A. On Nov. 2nd a minor operation was undertaken to secure a forming-up place (on the Happegarbe spur) for the general attack on Nov. 4th; a barrage was fired early in the morning and the attack succeeded, but at 09.00 hrs. a counter-attack developed; there was protective S.O.S. fire at frequent intervals during the morning, but by 15.30 hrs. the spur was lost.

Nov. 3rd produced an almost exact replica of the events of the previous day. (1.) The officer temporarily commanding 42nd Battery (its major was acting as Bde. Commander) was wounded. The shooting in connection with these two days' fighting had used up a deal of ammunition and it was a heavy task to collect the necessary dump (400 r.p.g.) by zero Nov. 4th.

During the last minutes before zero on 4th, 2nd Bde., R.F.A. was taken out of the pre-arranged barrage to repeat its barrages[1] of Nov. 2nd and 3rd in support of 96th Infantry Bde., who took the Happegarbe spur without trouble, *in their stride* (1.) Things were not very easy on the left, where 14th Inf. Bde. found difficulty in crossing the Canal about Ors owing to enemy machine-guns, whose activity formed the principal feature of this battle. At 09.05 hrs. the main barrage had to be brought back to meet this condition. The opposition was eventually overcome by moving troops (already across the Canal) Northwards along the Eastern bank. At 13.45 hrs. "Stop Firing" was ordered and the Bde. Commander went forward to reconnoitre; there was still, however, trouble coming from enemy machine-guns passed by our troops in the advance, and it was 16.30 hrs. before the batteries of 2nd Bde. were advancing (to Position No. 19). At 19.00 hrs. 2nd Bde. was placed under 161st Bde., R.F.A., which was already across the Canal at Ors, and there was a prospect of having to support exploitation on Nov. 5th. But the enemy retired, and some harassing of his line of retreat during the night were the last rounds of the war fired by 2nd Bde., R.F.A.

On Nov. 5th, the Brigade crossed the Canal and came into "observation" about Favril (Position No. 20); it crossed the River Petite Helpe on Nov. 7th and was again "in observation" (Position No. 21). There was to have been a barrage on Nov. 8th, but the enemy had again retired.

On Nov. 9th, 2nd Bde., R.F.A. was disposed E. of Avesnes (Position No. 22) with the enemy some 8—10 kilometres distant; the Bde. Commander returned from leave[2] in time to order the last advance

[1] The fifteenth organised barrage since 17 Sept.

[2] Methods of transit were many and various at such times; on this occasion they included, besides the usual lorry-jumping, a journey on the footboard of a pilot-engine testing a stretch of railway-line for mines, and a motor-car drive with the Army Commander at the wheel!

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on Nov. 10th. There were no squared maps of the country in which we were now fighting, but we never came nearer to battle after Nov. 10th than "positions of readiness." The remarkable features of the period covered by Chapter V. were (a) enemy use of delay-action mines (2.), (b) the able handling of his machine-guns, and (c) the bad weather, one result of which was that, in the last battle-position occupied, 2nd Bde., R.F.A. was split in two by an unfordable river; one had to go back into Avesnes. All things considered, casualties in this fortnight's advance had been fairly heavy—1 officer, 20 O.R., and 34 horses.

On Nov. 11th came the Armistice; at 10.59 hrs. the not-yet-completely-conquered, -in-defence-of-his- Fatherland-so-brave, - but-now-with-Republican-Ideas-imbued, German machine-gun-man, fired his last belt, took off his helmet, bowed, and walked away; the psychological effect on the soldiery of this sudden peace is tempting to discuss, but too ambitious for the author. Also it has nothing to do with field artillery tactics.

Comments on Chapter V. (1.) There are some positions in battle, as in Life, which one cannot occupy without going straight on; one must "either go on or go back." Such a one was the Happegarbe spur; another was Trones Wood on the Somme, which lay in an enemy re-entrant, and which was attacked and occupied half-a-dozen times between 7th and 13th July, 1916, by 30th and 18th Divs. in succession, before finally passing into our hands when the whole IV. Army line advanced on 14th.

(2.) The effect of delay-action mines was more strategical than tactical, for it interfered principally with the supply system; one cannot feed huge armies by hand or by aeroplane during the advance. The railway-lines about Avesnes were freely adorned with these instruments of war; every road-culvert, if not already destroyed, was probably mined; even if it was already blown up, there might be another explosion impending. These mines kept going off for long after the fighting was over, which caused great delay during the advance to the Rhine; they would perhaps have prevented pursuit, if the fighting had continued; may they even have influenced the decision to grant an Armistice? It would be interesting to know the date on which the last mine exploded, and the date, too, on which the last was timed to go off had not enemy representatives arrived to disclose them.

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END OF PART II.

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PART III.

SUMMARY.

The Transformations of War.

NOTE :—In the following pages, the writer has endeavoured to confine himself to a few deductions from the events recorded in Parts I. and II., and to interweave these lessons with the military tendencies of to-day; and this briefly. He has not forgotten the financial side of the question—the cost of changing armaments; but when a national crisis arrives, money gets freely spent to secure victory; nor has finality been reached in the development of the tank or the heavy gun.

A. THE INFLUENCE OF ARTILLERY UPON THE BATTLE AND THE FUNCTION OF FIELD ARTILLERY IN PARTICULAR.

Throughout the 58 days' fighting recorded, the function of the Field Artillery was almost entirely protective; i.e. the creeping barrage to cover the infantry during advance and the defensive S.O.S. barrage. There may at times have been some pushing forward of sections with the infantry for offensive tasks; there was harassing (and a little sniping) fire; generally speaking, the offensive duties were still performed by the heavier armament, though of course the duty of exploitation did to a certain extent increase the importance of field artillery support. In war-time, the cry has always been, and probably will always be, for a further-shooting, harder-hitting, and more reliable weapon that the enemy has got; hence the fifteen-inch howitzer and the tank, hence the battleship, hence the Zeppelin and the Handley-Page. The answer to the demand is governed largely by what the nation can produce or purchase and by the nature of the theatre of operations. It has happened that armament has become so heavy as to render its possessor defenceless through immobility; viz., the armoured knights of the middle ages and the heavy fighting ships of the Armada; it was not quite the same thing in the case of the battleship, because of the invention of the torpedo; otherwise, too, with the surrender of the Zeppelin to the aeroplane.

On the Western Front was a maximum of productivity plus purchasing power and a minimum of natural obstacles, so that the influence of auxiliaries (artillery and tanks) dominated at times that of infantry power. Frontages of offensive were chosen by the Allies (from fairly early in the war), according to where the attacker could produce the greatest artillery-power with the maximum surprise; the objectives were sometimes limited or arranged according to where the attacking artillery could support, or the defending artillery could not produce its full effect upon, the attacking infantry; the Germans endeavoured to extend their objectives to the capture of the defending gun-line. At the end of the war, the appearance of the tank affected, decisively no doubt, the course of the war. On only one occasion in the latter part

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of the war on the Western Front did a combatant rely primarily on his infantry to achieve his object—i.e. when the Germans practised on us in the Spring of 1918 the tactics already tried and approved at Riga; but then the Germans had no tanks.

The last thing the writer wants to suggest is that, even under the most favourable conditions, heavy armament (guns or armour), or new inventions, do anything but modify war—though of course, as in the case of gas and tanks, their influence is temporarily enormous; success must depend on national character, training, and resources. He does not hold that the basis of an army will ever be other than well-trained infantry, even if "mopping-up" (nettoyage), and the act of occupation, become at times its chief functions.

Away from the Western Front, the story was rather a different one. There were no tanks and few heavy guns. In rough countries, whose roughness is due to terrain or the uncivilised nature of the inhabitants, offensive duties no doubt did, and probably again will, fall to the lot of field artillery, which can generally be landed and used with *some* form of traction.

Warfare reached its highest (or lowest?) development on the Western Front *after an extended period of training and improvement.* There it would seem that the centre of the battlefield was a wall of fire, against or behind which the infantry moved, and which was created by the lighter guns, which we can group under the name "field artillery", but much of which was manned in our Army by the misnamed Royal Garrison Artillery. People say the "Creeper" was the outcome of stationary warfare; that it will not be feasible in a war of movement; that it will be replaced by "Concentrations", though this form of artillery fire needs as much control as does the organisation of a creeping barrage. No doubt there will be a period of movement early in any future war—*though not necessarily at once*, for, is it not conceivable that the initial conditions following mobilisation may necessitate a preliminary period of position warfare *on the land front*? one must remember also that a single night's work digging goes far to produce a battle of position. In the humble opinion of the writer, we shall do well to expect that infantry will demand some form of "wall of fire", both in attack and defence; but he admits that in a war of movement the supply of the necessary ammunition to provide this wall will be the difficulty, as it is also the principal argument for the maintenance of what we now call field artillery, because of the cheapness, ease of manufacture, and portability of the field artillery shell. Obviously, the heavier the armament, the less density will the wall of fire have, not only because of the increased difficulty in provision of ammunition on the battlefield, but also because of the increased physical exertion on the part of the gun detachments.

If one could easily move thirty-inch howitzers, their platforms, and their ammunition, and afford and carry an unlimited amount of both, would there be anything to prevent the entire armament of an army being thus composed? each weapon, for security hence for

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reliability, in its own steel fortress. But here we enter dreamland; nevertheless "If you can dream yet not make dreams your master . . . ."

A tank containing a field artillery gun is with us, the real object of the tank being reliability by securing the personnel and equipment from destruction. Surely this combination of gun, shield, and power of movement, may one day provide a possible solution of the problem of the "infantry gun"? the object of which is to provide attacking infantry with an artillery weapon for immediate assistance wherever they go. Note the old cry for a heavier weapon than the enemy's rifle or machine-gun! It is worth consideration whether some pack artillery of howitzer type should not be provided to form a reserve to the close-supporting weapons, to remain "in readiness" at direct disposal of infantry commanders on the spot. Defensively thinking, infantry will need support against the attacker's tanks; that support is not likely to be supplied by field artillery as we know it, or knew it yesterday, but rather by armoured anti-armour guns—viz. another form of tank, possibly firing fore and aft. One should not, however, forget that a moving tank provides a poor platform for a gun, which puts it at the same disadvantage against a stationary weapon, which the ship-gun suffers as compared with the coast defence weapon.

The deduction would appear to be that 18-pr.-(or 75 m.m.) armed field artillery (organised in batteries) will give place to tanks[1] in front (attached to infantry formations) and to heavier, probably mechanically-drawn, and perhaps armoured, weapons behind—their size being limited by (i) the feasibility of providing (in the field) enough ammunition to create the wall of fire, (ii) the question of moveable platforms or possibility of their use on the natural surface of the ground.

B. MECHANICAL TRACTION AND HORSE DRAUGHT.

There is no deed recorded in these pages which could not have been equally well performed by a reliable tractor—the terrain was, in fact, particularly easy to negotiate. Nor is there anything to show that substitution of mechanical traction for horse draught would have been an advantage. The writer cannot see that the arrival of the tractor will alter field artillery tactics. But of course this is not the last word to be spoken on the subject.

Can a tractor go where a team of six horses can? Bad weather, causing boggy ground or a greasy surface, obviously gives preference to horse draught; steep mountain tracks, such as we had on the High Veldt in the Transvaal, call for the tractor; experiment will decide this point.

Will the tractor be able to get away after unlimbering as quickly as a six-horse team? Was there any necessity for such quickness on

[1] Subject, of course, to the far-reaching proviso that a suitable type of tank is evolved.

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(say) the Western Front? One thinks of a tournament display by a well-trained horse artillery battery—of "Saving the guns at Maiwand"; but under close-range fire of the modern machine-gun or the Q.F., both team and tractor would probably come to grief. It is possible that some of the dash in limbering-up and unlimbering came under the head of showing-off; the practical utility thereof, some people might say, was based on an attractive hypothesis. Demonstrations of quick and perfect drill are useful if superimposed on efficiency; there exists a danger of their becoming a substitute for it, and it is interesting to note that a common complaint to-day amongst German ex-officers (*of other arms*) is that their field artillery posed as cavalry rather than as gunners.

But there is one result of the change possible, which is far more interesting. The cry in peace-time is always for mobility, as it is in war-time for weight—at least it always has been throughout the writer's military life and studies. It is the old struggle of weight *v.* mobility, comparable to that between the gun and armour in the Navies of the World. Now that we have the tractor, *we shall not be limited by the weight* which can be drawn by 6 horses (as much are convenient to manage at a trot); the supporters of mobility will be deprived of their chief argument. So far as the possibility to draw it is concerned, the field gun of the future may be a considerably heavier weapon, from which the conclusion seems again to present itself that the 18-pr. and its opposite numbers will disappear before the heaviest gun that can be emplaced and moved about at a slow pace on the battlefield.

Some of us must naturally regret this, but progress demands a certain sacrifice from tradition. In such a question sentiment carries no weight. For a time finance will say its powerful word, but another day of stress will surely come. Small wars must be considered, but will there be any conditions in which it is possible to use the horse-drawn field-gun and feed the horses, when it is impossible to use and supply an improved tractor?

C. CONTROL AND COMMUNICATIONS.

Again to re-quote the precept given in a lecture on Artillery at Camberley—"guns must be controlled, but the principle of control is subordinate to that of co-operation." The practice is harder than the precept, unless you evade the problem by saying that control is a means to co-operation.

Against a brave, highly-trained, well-armed, enemy, advance is no easy matter; either you must conceal yourself or provide yourself with armour as impenetrable as will still permit of movement. The 18-pr. of 1918 was not suitable for such an advance; the tank of to-day possesses the elements of suitability. The object of decentralisation (or decontrol) is more immediate co-operation, and there is, one would

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think, no reason why the latter should not be attainable by means of the tank.

It is otherwise with the "wall of fire" which forms the main obstacle to preservation of life in a modern pitched battle; this wall needs organisation before, and some control during, its period of existence; so do "concentrations" on selected localities. On the Western Front the battle-line was continuous, no portion independent of events to either flank,—another reason for control. Leaving aside consideration of war against an untrained enemy, it was a favourite theme of the present writer (before the war) that a battle of encounter would begin, as regards artillery, with decentralisation; but as the battle stabilised, decentralisation would give place to control, which would not disappear until one side retreated; decentralisation, of course, in the pursuit. But we had no battles of encounter or pursuits after the first few weeks; it was only at the very end that, on the Western Front, regimental commanders began to have responsibility other than as regards organisation and administration; the artillery was always controlled.

How can a commander control on a modern battlefield without artificial communications? They are the very essence of management of artillery other than armoured guns accompanying the infantry. No doubt the heavier artillery suffered at times from failure of communications, but it was generally outside the zone of *constant* breaks, and it was less often on the move. There is no more desperate case than that of a field artillery commander, whose group is close up to the line and dispersed over a wide area, when he is asked to bring fire to bear here and there in a moving battle; the infantry, long accustomed to trench-warfare conditions (the principal of which was for field artillery buried lines), hardly seemed to appreciate this; it is for that reason that the writer has laid so much stress on the early location of combined infantry and artillery battle headquarters. It will probably be admitted that heavy guns are usually disposed in an area where mounted orderlies can be maintained; even visual is often possible; neither of these means are generally available for the advanced artillery elements. The training manuals grant that infantry once launched is out of control; but really it is the same with field artillery, especially on the defence or during a not perfectly successful attack.

The solution would appear to lie in the direction of wireless, *especially for field artillery*, which is generally long enough in each position to make it worth while to put up a wireless installation. It is not suggested that this is an easy solution; a great deal of experience, technical improvement, and training, is required; but it seems to the writer that in this direction there is hope for solution of the problem. The problem should be more easily solved the further the guns are back from the zone of smoke and close-range fire; i.e. if the function of close support devolves on tanks, and that of the wall of fire on field artillery armed with a heavier and longer-ranged weapon.

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D. DISPOSITION OF FIELD ARTILLERY ON THE OFFENSIVE :—

In Part III. of the previous article ("F.A. Group in Retreat"), the writer recounted nine conditions governing good support by artillery; he begs leave to repeat them here :—

1. A good system of command. *N.B.* The splitting up of a Brigade staff to command a large Group militates against this first condition, unavoidable though it may be.
2. Good distribution. Suitability to the most probable course of the battle. Think also of the possibility of counter-attack. What is afoot to either flank of your area? Reconnoitre advanced and alternative positions.
3. Mobility. Concealed approach and easy exit.
4. Good observation. This includes arrangements against alarm by day or night. It is an essential, especially on the defensive (even if only temporary).
5. Good liaison—with superior authority as well as with units of the Group—with the infantry, ça va sans dire—with any heavy artillery units in the neighbourhood.
   It includes the collection and sifting of information from all available sources. It is the duty of every unit in an army to keep touch with its neighbours.
6. Good communications.
7. Safety and comfort of personnel, including that of wagon-lines. Camouflage. Enemy gas. Rations.
8. Good Gunnery. Sights tested daily. Care of ammunition.
9. Good Equipment, well maintained. Good relations with representatives of the Mobile Workshops.

It is a platitude to observe that the general offensive may easily turn for a time into the local defensive. In the latter days of March 1918, it did not seem to us that we were in position to do much counter-attacking, but counter-attacks do take place even when troops are hard pressed—the battle of Guise for example in 1914; it is just a question of reserves. One is not in a position to know whether the enemy is hard pressed, when he is fighting about a long-prepared defensive line of great strength; in Part I. of this paper, it was a question of the approach to an as yet unpunctured fortress. A group-commander must bear in mind the possibility of such a contingency, to meet which his batteries must be dispersed in depth,—and this holds good whatever the nature of the guns composing the group armament. Positions suitable to the close support of an attack in the open do not perhaps suit when it is a case of attacking an enemy holding advanced posts in front of a main position. The old-fashioned *very close* support is indeed rarely possible under modern conditions; the flat trajectory of the field-gun of to-day renders it difficult; the mobile trench mortar was used with good effect in the great German offensive, a thing which we might have done well to imitate.

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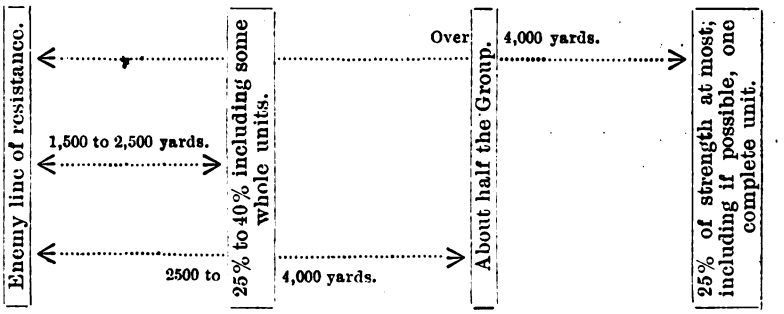
The writer suggests that about 25% of the Group should start the action close up, so that it can continue to have efficient range for a proportionably long time; and that (say) 25%, starting at a longish range, should be kept ready to move at once. Diagramatically put :—



If there is a serious hold-up which shows signs of lasting through the night or longer, it would seem best to re-dispose the Group forthwith, so that it can fire an efficient S.O.S. defensive barrage, even if a few guns have to be withdrawn; the idea that the sight of artillery withdrawing (at leisure) will alarm the infantry is an insult to the latter; it comes down to us from a past century. (There are of course exceptional cases.)

Change of position in the advance is not altogether the same as change of position during the retirement. In the latter case, it is certain one will have to fight on the new position—probably at once; in the writer's opinion, as expressed in the former article, it is better to send back one section per battery to "warm" the new position—i.e. to make such arrangements as will ensure that effective fire can be opened from it at the earliest possible moment. One can pursue the same method in the slow advance on a limited objective. But where there is a possibility that the enemy may break, it is easier to achieve efficiency quickly; moral is at its height; there may be no need for concealment at all—flash cover at any rate need not be so carefully studied; one wants the most efficient fire-unit on the new position as early as possible, and the most efficient fire-unit is the whole battery. The advance, therefore, seems better carried out by the whole batteries within each brigade.

Even in the only-half-open warfare of the last days of the war, the need of reconnoitring the country in front of them while still in action, of choosing new positions against time, and of "shooting themselves in" quickly on arrival thereat, discovered weak points in the military ability of many a battery commander who had reached his post in slower times. Many officers got quickly used to the new conditions; but a B.C. with a real talent for the work was a jewel of great price. It can be taught; the map at home, then visiting the ground itself. The brigade commander alone (in most cases) can decide, by means of his intelligence service, the moment to advance, but he cannot do more

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than indicate the valley (or other area) where the new position is to be; the niceties of choice must be left to the battery commander, as well as local security. Indeed, the writer himself made a principle of never laying down the *exact* position for a battery, except very rarely when an officer was temporarily in command, of whose judgment he was uncertain; suggestion is quite a different matter.

It might not be out of place here to remark that in the advance the wagon-lines are often far behind; the supply of ammunition under such circumstances gives hard work, and the unit commanders get no opportunity to visit the unit "homes from home"; administration must not be forgotten.

E. OBSERVATION.

It is true that the principal duty of field artillery in the latter part of the war was the Creeping Barrage, fired off the map. Nevertheless, good observation is an essential for support to the infantry. Terrain has a great deal to say; it was easier in Picardy or Artois than in Flanders; ground observation is however, *always difficult to obtain in satisfactory measure.* On the whole it is easier when the battle moves; there is less hostile fire, except at certain periods, when indeed all observation fails owing to the smoke of the battlefield; what hostile fire there is, is directed chiefly against infantry masses and main roads; when directed at likely O.P's, it is neither so well considered, nor so well registered. Again, our F.O.O. finds more obvious targets.

With all this, there remains the bugbear of communications; and that the battle has a way of becoming important at just that point which one cannot see.

One's thoughts fly to the air. The Heavy Artillery of course had the advantage over the R.F.A., with their Observation planes working for the Counter-battery officer, and their "Sausage" balloons. It is not likely that field batteries will obtain the services of many planes; perhaps not a very great deal is to be expected of air observers as regards small-calibre shells. On of the best-known of Ole Lukoi's stories in "The Green Curve" is based on the doings of a kite attached to a Field Artillery Group Headquarters; it really seems as if more might have been attempted in this direction during a war of new inventions; for use of the kite rids us at once of two great difficulties—one can see all the ground and one gets immediate and direct information of what the observer has seen. But, indeed, the writer has no personal experience of kite-work; or perhaps he would not have lived thus to trouble the reader.

F. SEPARATION OF HEAVY AND FIELD ARTILLERY.

About 1896 the Regiment was split into "Horse and Field" and "Garrison", which event was (the writer believes) the occasion for the publication of Captain Cleeve's never-to-be-forgotten "Creed." Presumably, what was in the minds of the then Authorities, was Training. It was, and has been ever since, a subject of controversy. The writer

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can only quote his experience as a General Staff Officer not higher than in a Division and as a Field Artillery Commander; this limited experience has produced in his mind two arguments *for* amalgamation and none against it. These two arguments are, (i) inexperience by each branch of the other's limitations and capabilities, of its "conditions of efficiency" so to speak; and (ii) a certain rivalry, due—shall we say?—to competition for the good opinion of the Infantry (equally revered by both branches), but often misunderstood by the latter, especially when they find themselves obliged to deal with two seperate artillery authorities. The two branches are really one, wherever it concerns weapons which can move with reasonable ease over the battlefield; in the writer's opinion, they are now more than ever likely to have the same sort of work. Whatever be the final decision of the Authorities of To-day (or the Future?), one would think it should not be influenced by such a thing as temporary inconvenience in the adjustment of personnel. It is, however, much easier to generalise on such a point than to make a responsible decision, and the writer craves pardon for his generalisation.

G. NEW DEVICES OF WAR AND THE STAGE OF DEVELOPMENT REACHED BY THEM IN AUTUMN, 1918.

Briefly to summarise these developments as illustrated by the narrative in the foregoing pages.

In doing so we must remember that 6th Division was not engaged at a decisive point; that is to say, it was not a spear-head; its importance lay rather in its proximity to our Allies.

We will take first the Creeping Barrage (the story of whose development would fill many pages), as being the one thing which maintained the importance of the British field artillery to the very end of the war. The Germans had rather neglected their field guns; they had been used for some time past for plastering our area with mustard gas, but played a fairly important rôle (in sections) during the retirement; in the German army, during the last half of the war, field artillery seemed scarcely a first-class arm. The French field artillery maintained its influence, at any rate in part, by the national sentiment towards the soixante-quinze. We see in these pages (Sept. 19, 24, 30, Oct. 9 and 18, Nov. 4) that the "drill" of the Creeper was understood in our army; that a barrage could be fired with only the briefest instructions at short notice, provided the ammunition was available—provided also that the Infantry would give way as regards their line of departure. Registration was hardly ever thought of in these days; lack of range was what most hampered us—compare the ease of the task of the French "75" group on Sept. 30. There was a development at the end, however; the period of limited objectives was dying; there was now exploitation and, in the absence of heavier guns, exploitation demanded from the field artillery offensive action as well as the protective duty of the Creeper; in fact, movement increased the importance

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of field artillery in *all* armies. The writer believes that the Creeping Barrage has come to stay (in some form); what is really against it as a device of war is the amount of ammunition it uses.

The writer had little to do with the Heavy Artillery during this period—not nearly so much as during the German Spring offensive or the Summer's defensive about Ypres. A Heavy Artillery Brigade was now more or less an integral part (nominally "attached") of each Divisional Artillery; we knew it could move almost as easily as the field artillery; in other words a portion of the Heavy Artillery had become heavy field artillery. It kept improving in what was perhaps its primary duty, counter-battery work, in which the field artillery (4·5 inch howitzers) lent an occasional hand—but the latter needed practice in this department, as well as longer range, and perhaps also more attention to platforms. The development of heavy artillery was surely one of the important things of the war? Heavy artillery seems to be a weapon of the future, whereas field artillery may be one of the past; why else did the peace treaty (Treaty of Versailles) abolish the German Heavy Artillery?

What was *our* experience of Tanks? We had participated in a tank attack on a grand scale at Cambrai in November 1917, on which occasion it had seemed that the creeping barrage might almost have been dispensed with as regards man-killing projectiles; such an attack demands (a) surprise as regards concentration of the tanks, (b) smoke to screen the advance—a field artillery duty, (c) good counter-battery work to knock out what the enemy may use as anti-tank weapons. In the period covered by this narrative, tanks, in small numbers only, had on two occasions (Sept. 18 and 24) supported attacks on the Quadrilateral, which became a tank cemetery, and was eventually captured by infantry unaided. Some whippets were told off to assist W. Yorks Regiment on Oct. 8, but were knocked out; the task was performed by infantry with the assistance of field artillery using some smoke. Tanks failed again to assist 71st Inf. Bde. on Oct. 11. When we came up against waterways (Sept. 29, Oct. 20, and Nov. 4) we had of course to do without their help, whatever the tank of the future may be capable of. The prospective use of tanks as close-supporting artillery will call for much technical development; and the problem of co-operation between these tanks and the infantry they are supporting, is not so simple as it looks. But improvements will come with time and training; it certainly seems to the writer that in this direction we may expect novelties; and if tanks are to provide the close-supporting artillery of the future, let us hope the Royal Regiment will get its just share in the development of this new arm.

Little has been said here about Gas and Smoke. We used mustard gas for the first time on Sept. 29, but one knows nothing of its success or otherwise, for it was against an area which we were not to occupy. Altogether, in our experience, the use of gas was generally limited to "harassing" in between our own, or in assistance to our neighbours, attacks. The writer remarked in his previous (The Group in Retirement)

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paper that a suitable opportunity for the use of gas was against the enemy's area of assembly, and we had a good example of this when the Germans used gas shells with effect against the assembly of 18th Infantry Bde. about Vaux Andigny on the night Oct. 16/17. Captain Lefebure in his "Riddle of the Rhine" suggests its use as an anti-aircraft weapon. There was much talk of Smoke, but the ammunition was not always available. Everyone must have seen for himself how smoke blears the battlefield; at the moment when one is attacking, everything which makes for ease in obtaining and communicating information is demanded, even though such conditions may also help the enemy; it is notorious that the use of smoke interfered with the counter-battery service. One would deduce that the use of smoke should be confined to certain definite occasions. With both gas and smoke climatic conditions have the last say, and the use of either must often be left to the initiative of the responsible commander on the spot at the last moment.

Now for the Air—and here indeed is an occasion for the Dreamer! Who can tell what the future may bring? Let us confine ourselves to the period covered by this narrative. Enemy aircraft was, so far as we could judge, chiefly employed in bombing (a) depressions in our forward area—against personnel, (b) roads, bridges, wagon-lines, and probable rest camps—principally against our supply system; and that chiefly at night, and very well carried out. Our aircraft was presumably engaged in photography, the counter-battery service, and bombing raids. The development of aeronautics has re-introduced the artillery duel, in which "God is on the side of the strongest Artillery"; the attacking artillery is presumably the strongest at the moment of attack; good air-work therefore assists the attacker and should continue to do so until someone invents a satisfactory anti-aircraft weapon, device, or method. If a good anti-aircraft gun is forthcoming, one may expect to see one in the equipment of, at least, every brigade of field artillery; pending that day we must pay all possible attention to camouflage and the protection of personnel. May not artillery have to play a part in the development of air-fighting also, as in that of tanks?

A few other points. Scientific calibration in a back area, combined with training and experience on the part of our personnel, enabled us to fire unregistered, which made us more than ever dependent on accurate maps, which in turn demanded from battery commanders accurate resection of their positions; note that squared large-scale maps began to fail us in the last days. The unregistered barrage allowed of surprise as regards the actual moment of attack and the actual target of the spear-head; serious wire could be dealt with by tanks—though, as late as Oct. 13th, 1918, there was talk of cutting new-found wire with field guns. The enemy was on the move, and *at last being pressed all along the line;* he had no time to continue his scientific development of the defensive on a limited front against a limited-objective attack, as exemplified during the 3½ months of the Battle of Flanders (or Passchendaele). Counter-battery work had reached a very high

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standard. Machine-guns had taken up barrage duties in assistance of the field artillery, as well as offensive duties in support of exploitation; but to the very end we had not yet solved the problem of how to deal with enemy machine-guns on defence. We had not conspicuously developed high-angle short-range fire for close support, as could possibly have been provided by mobile trench-mortars.

H. TRAINING AND PERSONALITY OF JUNIOR OFFICERS, AS WELL AS N.C.O's, OF THE R.F.A.

As the writer is probably at the end of a long, and by him treasured, connection with the Royal Regiment, he may perhaps be forgiven for uttering the following platitudes.

We have first to deal with professional soldiers. First-class War has taken, so to speak, a turn towards mechanics; whereas we needed a young officer or N.C.O. to ride well and be a horse-master, we now require him to manage a car and to fly. The shooting of a battery and care of the section gun-park, as understood when the writer was a subaltern, is a very different thing from the intricate business of to-day, which requires expert knowledge of equipment (recuperators, etc.), communication-means (wireless), ballistics, and the management of explosives under varying climatic conditions—to mention only four branches of an officer's work. It was suggested in the R.A. Journal some time back that an artillery officer should be capable of acting as "traveller" for armament firms, should be able to show off equipment. More recently an officer wrote an article recommending that the captain should be responsible for the whole equipment of a battery and should not be permitted to reach that rank without passing a course in the "Shops", nor be promoted until he could properly perform his duties.[1] All this shows a tendency to specialised professionalism and to making a Gunner officer what other arms have long believed him to be—a "scientific" man. The writer's recent experience on the Continent was that in the French and German Armies, he is already that to some extent; the French president of the Inter-Allied Commission of Control expressed surprise that a regular artillery officer of considerable seniority had had no factory experience; a very leading German manufacturer of war material, on hearing that the writer was a regular artillery officer, remarked "Das Ist Schon Etwas" and proceeded forthwith into the realm of advanced science. It seems worth noting as a tendency with regard to the training of the future officer or N.C.O. To go to simpler and quite old-time ideas much might be done (as regards the Regular R.F.A.) in (a) training officers in the tactical handling of a Group first on maps indoors, then visiting the ground, (b) better umpiring of Group and Battery *Tactics* at manœuvres, (c) training young N.C.O's and recruits by the use of single guns and percussion shells on selected spots close to barracks; these are the writer's—fads?

[1] During the last few years, the writer has been working with a number of ex-I.O.M's., some of whose criticisms of our care for our equipment (in the gun-line) were more illuminating than complimentary.

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· No. 2 MAP ·

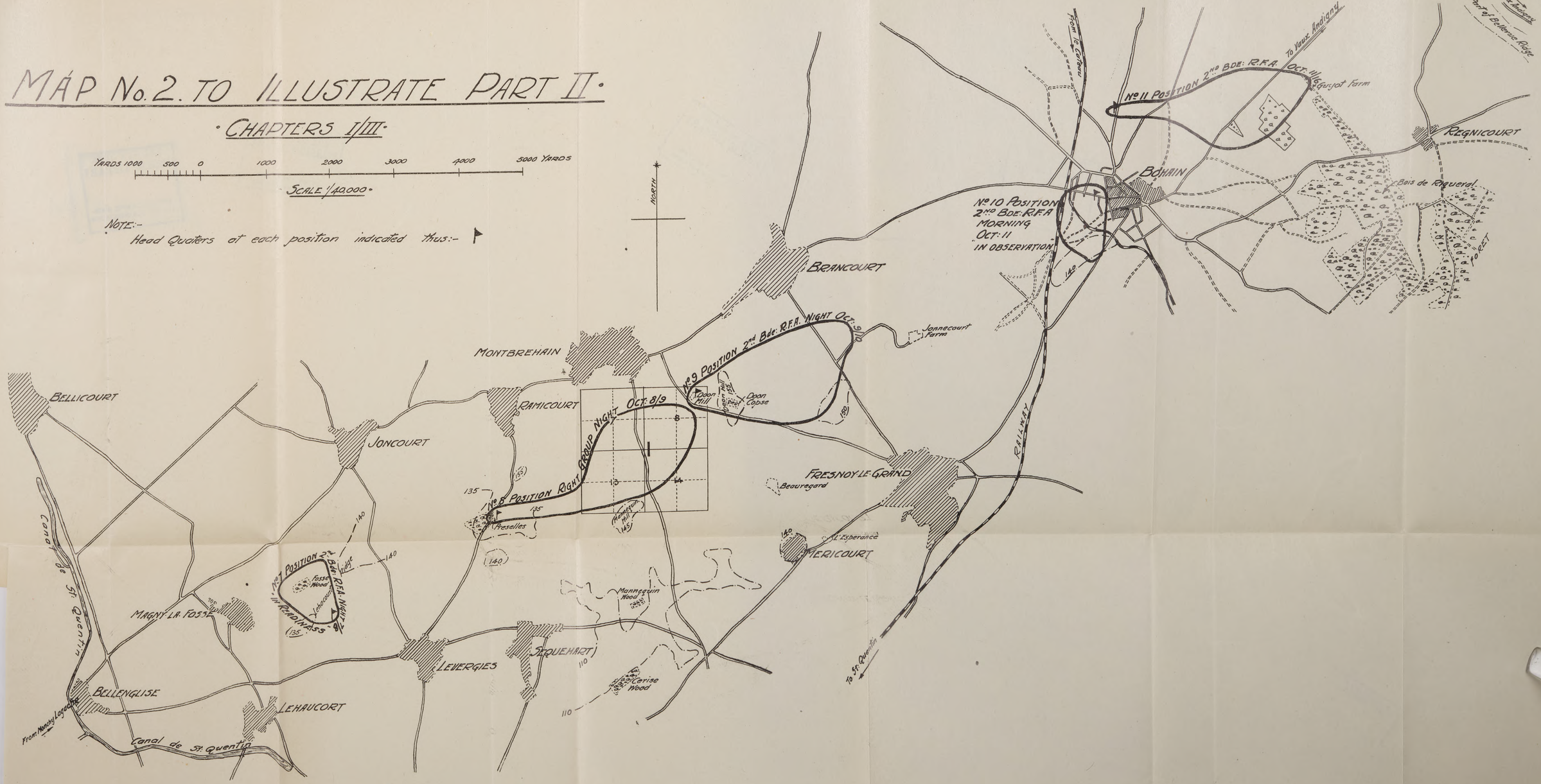
MAP No. 2. TO ILLUSTRATE PART II.

· CHAPTERS I/III ·

YARDS 1000 500 0 1000 2000 3000 4000 5000 YARDS

SCALE 1/40,000.

NOTE:-
Head Quarters at each position indicated thus:- ⚑



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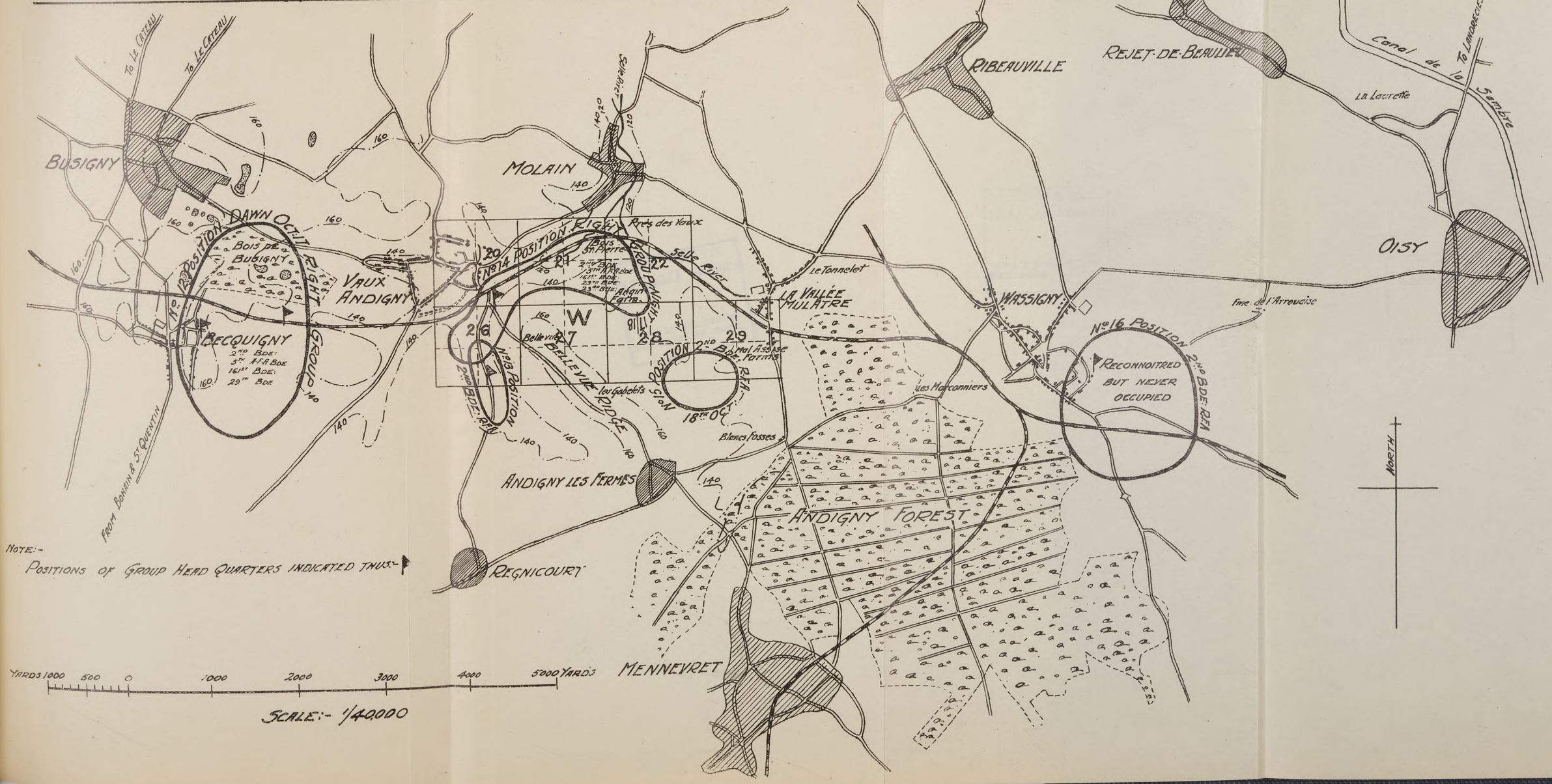
MAP No. 3 TO ILLUSTRATE PART II CHAPTERS III & IV.



NOTE:-
POSITIONS OF GROUP HEAD QUARTERS INDICATED THUS:-

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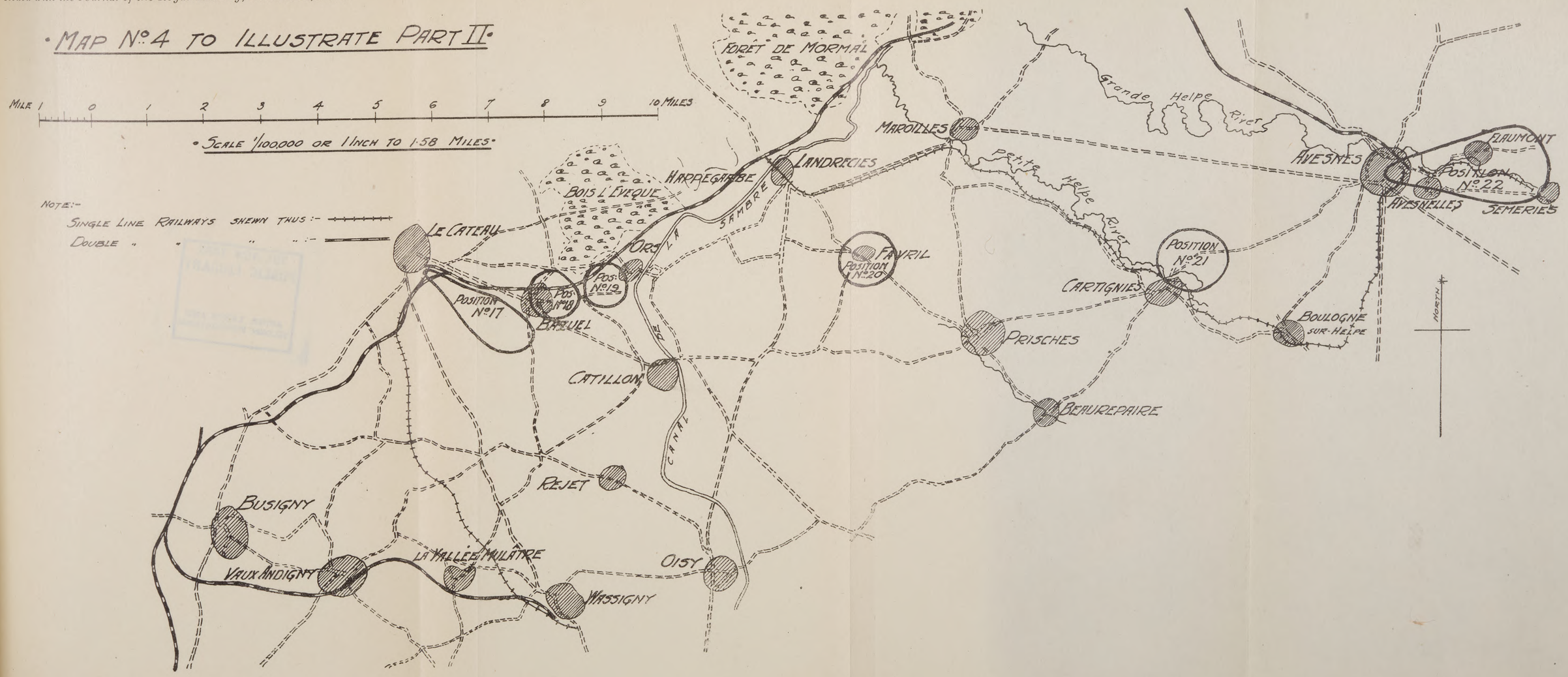
MAP No. 4 TO ILLUSTRATE PART II.



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But practical experience steps in to show us that after a short, all too short, period of first-class war, we no longer have with us our complement of regulars. There is one constant change of personnel in process. Now some men's characters are obvious at short acquaintance, but in far more cases character appears like the dim outline of a mountain behind the morning's mist; only with acquaintance, as with sunlight, does the mist roll back and disclose some, at any rate, of the truth. It is generally admitted that the art of command lies largely in putting the right man in the right place; the study of character is a chief duty of a senior regimental officer; there are other ways of dealing with an apparent 'failure' than merely returning him to the base. This leads to the platitude that the commander must be constantly in touch with the personnel under him and must form an opinion for himself of each man—a most difficult thing for a man to do, if not imbued with a sense of the superiority of his own mentality, or who does not hold that seniority is the principal basis of authority; it *should* be so, but only is, when an officer has throughout his service set himself to acquire the knowledge which gives that authority. The writer wishes not to be sententious—it is this way; if the C.O. does not seek out his new officers, it is very unlikely that they will jostle over one another to seek him. Whatever the conditions in battle or at rest, whatever its seeming disadvantages—such as personal fatigue when all your mental power is required in the headquarter office—such as apparent waste of time—*never neglect the daily visit* to each unit under your command.

Conclusion.

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THE REGIMENTAL JOURNALS OF THE UNITED STATES ARTILLERY.

BY MAJOR-GENL. SIR JOHN HEADLAM, K.B.E., C.B., D.S.O.

SINCE the appearance of the last article under the above heading, the various Journals of the United States Artillery have well maintained their interest for readers of the *Journal of the Royal Artillery*. And, since we have decided to follow their lead in leaving the choice of subject for our Prize Essay to the writer, it may stimulate some prospective competitors to know those chosen by this year's prize-winners in America. Here is the list :—

Field Artillery.

1st Prize.	Artillery Ammunition Supply.
2nd Prize.	Some aspects of American Field Artillery.
Mentioned.	Impressions of a Corps Munitions Officer.

Coast Artillery.[1]

1st Prize.	Coast Artillery Training.
2nd Prize.	The organization of a Coast Defence for war.
	The Test System of Instruction.
Mentioned.	Land Artillery to the fore!
	What ails our fire control telephone?
	The future of our minor armament.
	The casemate electrician.

The essays are in course of publication in the Journals, and can thus be obtained from the Institution. For English readers the Field Artillery 2nd prize will be found of most interest, for it discusses so many matters which have agitated us—artillery staffs, schools of gunnery, six-gun *v.* four-gun batteries, infantry at practice camps—and the difference in the writer's standpoint often adds value, as well as pungency, to his arguments. Though the subject does not (perhaps unfortunately) directly affect us, the description of the benefits resulting from the appointment of a "Chief of Field Artillery" is well worth attention.

TACTICAL.

Among the papers by American writers, priority must be given to the series of memoranda on the employment of artillery issued by the Chief of Artillery of the American First Army during the St. Mihiel and Argonne Offensives. Here again the problems dealt with are those which were familiar to us all during the War—liaison, co-operation,

[1] The term *Coast Artillery* means much the same as our *Garrison Artillery*: It includes Anti-Aircraft, but not "Medium" which is part of the Field Artillery.

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choice of position, care of ammunition, camouflage, march discipline, duties of "army artillery", "accompanying" and "roving" guns, &c. But if the subjects are hackneyed, the way in which they are dealt with is in somewhat startling contrast with the usual style of our official pronouncements! Here are racy paragraphs, full of robust humour and common sense, and revealing the writer's personality in every line. The temptation to quote must be resisted, but a few extracts may perhaps be allowed, in the hope that they may tempt to a study of the originals.

Here is a sympathetic touch from the memorandum on the issue of orders:—"Anything that increases the interest of the soldier increases his efficiency and his value. His greatest interest is exactly the same as that of every officer—what is being done to injure the enemy, and what is its success. If men are told to fire 10 rounds at point 32.46 they will do just that. If they are told 'There is a wagon trail of fourteen wagons just approaching point 32.46, fire 10 rounds on that point', they will put a maximum of careful effort into every shot. If the shoot is observed to be successful, and a report of its result is sent to the battery, the men will talk of it for days, and half of them will try to get it by the censor when they write home!"

And he can be sarcastic too:—"There is a common desire to . . . unwarranted by allied experience of *several years, or by our own of the past few weeks*!"

Similarly, on the subject of "accompanying guns":—"Some artillerymen are too narrow-minded, and too resentful of what they call a violation of the principle of unity of command, to be willing to detach pieces . . . . Some artillerymen are too ignorant of the problems which the infantry have to solve to realise the great assistance which can often be thus given. There have been repeated instances on the present front of their effective use, of their abuse, and of their neglect. The first duty of an advance piece is to be an advance piece—*not to have some good reason why it could not get up. Its mission is to accompany the infantry, and help them in their emergencies, not to save horses.*"

Here is an arresting description of an addition to the artillery:—"The 155 m.m.[1] G.P.F. gun has an extreme range of almost exactly ten miles, and a traversing arc of 60 degrees (one-sixth of a circle). These are extraordinary characteristics. The gun has been, and will continue to be, a saviour of doughboy lives. Unfortunately its life is only about 3000 rounds, and it has other limitations. Its track is very wide—8 feet . . . . it often stirs a foolish impatience and resentment among military police, traffic regulators, and staffs, very unworthy of them. In order to save its life, and devote it to the best purpose, it has been kept at the disposal of the Army Artillery. The Army Artillery cannot force its amicable intentions upon any Corps,

[1] The first French *groupe* to be armed with these very remarkable guns was with the French army on our left at the Battles of Ypres, 1917. Any of my readers who visited them will have a lively recollection of the pride of all ranks in their weapons, and of the truly Gallic humour of the badge they had designed for themselves.

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but it offers its services, describes above its powers and limitations, and bespeaks the goodwill of G (1)'s, and the Military Police, in order that its powerful assistance may be devoted to the support of the infantry."

But the General can be severe too when occasion demands: "That the artillery is obtaining very great and important effects upon the enemy cannot be denied. I think we are all proud of it, but it is obtaining these effects at an enormous expenditure of ammunition and of consequent effort, fatigue of men, wastage of horseflesh and breaking down of motor truck, congestion of traffic and wear on roads. So, although I see a great improvement, I believe that the artillery must be pushed closer to the front. . . . Brigadiers with considerable staffs are remaining in dug-outs and giving directions from the map based on scarce and late information received over imperfect lines. Subordinates are painfully scaling distances from the map, and applying corrections by mathematical computations. *Much better results, many more dead Germans, killed horses, and destroyed vehicles, would be found if a genuine, energetic effort were made by all concerned to get direct observation and personal knowledge.*"

And here is some pretty straight talk:—

"I hear that . . . . expressed themselves quite forcibly very recently against this idea of moving artillery way up front, saying that it only got shot up and out of hand. My only answer to such ideas is that their artillery is not trained to fight in open warfare (and this type requires more skill than firing a barrage), and that their artillery gets out of hand because they are themselves too far back to keep it in hand."

* * * * * * *

"One Infantry Brigade Commander had the situation quite well sized up I thought. He said that our artillery was fine in carrying out an operation which could all be planned and laid beforehand, but that when it was required to act in situations which had not been foreseen and planned beforehand, it fell down."

To turn from practice to theory. In a previous notice (*Journal of the Royal Artillery*, page 396) attention was drawn to a very lively account of experiences in France with "accompanying guns", in which the writer strongly advocated this form of support. A recent contribution to *the Field Artillery Journal* takes the opposite view. The argument, briefly stated, is that the automatic weapons of the defence, which hold up an advance, can never be subdued by the infantry, whatever accompanying guns they may be given, because it is an impossibility to supply these with the necessary amount of ammunition across the battlefield. They must therefore be dealt with by the main body of the artillery, which must *stay still and shoot*, and not attempt short advances on the battlefield in the vain hope of making the problem of maintaining liaison with the infantry less difficult. Such moves

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interfere with its fire just when it is most required, and it will not be possible to bring up sufficient ammunition to the new positions. It is only at night that the artillery should move, and then it must make one bound of as far as the infantry can advance in twenty-four hours. In the writer's view, the real problems of the artillery are :—

(1). To keep up communication with the advancing infantry.

(2). To move by night to new positions in the restricted and congested area, and to occupy and supply them before morning.

(3). To shoot well by the map, by observation, and by topographical calculations where no maps are available.

TECHNICAL.

An article on "Post-War Ordnance Development" in *Army Ordnance* (the organ of what corresponds to our Directorate of Artillery) is well worth reading, for it gives, in quite simple terms, a comprehensive review of the general progress and accomplishment of the Department, "whose duty it is to take counsel impartially with both user and designer, and weigh the considerations advanced by those with either view-point," during the three years in which it has been able to undertake "an orderly study of the types of munitions which the War has indicated as necessary for a successful and economical utilization of our man-power in future wars."

The writer ranges over the whole field, from the latest developments of Coast Artillery in the monster 16″, 50-calibre, "rifles" on disappearing mountings, to the "accompanying gun"; from 4000lb. aeroplane bombs to mechanical time-fuzes. He gives also the results up to date of several important trials which have been in progress for some time, such as those of split-trail carriages for field and heavy guns, and of inter-changeable carriages for guns and howitzers of these natures. The conclusions arrived at so far appear to be that a box-trail carriage, giving 45 degrees of elevation instead of the 80 degrees of the split-trail, allows of a very considerable saving in weight, while the sacrifice of inter-changeability increases stability.

The great question of motorization receives its due share of notice, and here attention will be naturally attracted to the summary of the results of the experiments with *self-propelled-gun-mounts*. When in America the writer of this Review was told by Mr. Holt—whose name is so well known to all interested in mechanical transport—that the self-propelled gun-mount was the development which had the greatest personal interest for himself. Certainly the very ingenious applications of both the ordinary caterpillar type and the removable track type which have been under trial are well worth the attention of all gunners, whether technical experts or not. So far this principle has failed to show sufficient durability, and the trials are now being devoted to ascertaining whether the failure is due to conditions inherent in the principle, or to its defective application. To those who wish to study the subject in more detail the series of articles in *Army*

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Ordnance on "Self-propelled Track-laying Artillery" are specially recommended. But it must always be recollected that the whole question is still in its infancy, that its possibilities are as yet scarcely realised, and that even if all technical difficulties are overcome, it will still be a question whether the self-propelled type is sound tactically.

It is of course in these technical papers that the profuse illustrations of the American Journals are so particularly valuable, as indeed the readers of the *Journal of the Royal Artillery* have lately had an opportunity of judging. But the most effective has not yet been reproduced, and it is worth getting the *Field Artillery Journal* for it alone, for it shows the whole of a Divisional Artillery motorized. All is as it should be—guns and wagons drawn up on ceremonial parade, gunners at attention on their boxes—but the teams have given place to caterpillar tractors, and the Brigadier's charger is a limousine! To most of us, I think, such a photograph brings home the inexorable progress of science in a way that no amount of reading can do.

FOREIGN.

The extracts from Foreign Military Journals—including our own—are, as always, well selected and admirably translated. We all knew "Big Bertha", and here we have an unvarnished tale of her doings in "The 42 c.m. Mortar—Fact and Fancy" by a battery commander. To those who served in our own "Super-Heavies" his account of the obstruction he had to contend with in his efforts to get proper use made of his tremendous power will specially appeal—how, for example, he was forced, in spite of all protests, to waste his priceless ammunition upon trenches and towns, where, as at Ypres, the same total weight of more moderate sized projectiles would have given vastly more effect. Howitzer men will appreciate his account of the impossibility of making the Higher Authorities understand that the Templars' Tower at Nieuport was a more suitable target for a flat trajectory gun than for a piece with an angle of descent of 70 degrees. And all gunners must sympathise with his satisfaction in recounting the success of his shoot on the Antwerp cupolas, and agree that the conduct of the fire must have been a pleasure to any artilleryman.

Another account from the enemy's side, "Truths from the German Front" is also deserving of notice. The author served as subaltern company commander, and regimental adjutant in the German Infantry, and so knew well where the shoe pinched, and is not afraid to tell. Though no doubt too much inclined to lay blame for everything that went wrong on either the Staff or the Civil Authorities, the truth of many of his comments will be acknowledged by all regimental officers at any rate. For instance the bitterness in the ranks caused by the ridiculous accounts in the press of the demoralisation of their opponents; the interference of the higher staffs in the details of daily work at the front, and the failures and loss of life caused by their ignorance of the time it took for their orders to reach the men who had actually to carry them out; the waste of money, material, and labour in supplying useless mechanical contrivances to troops who refused to

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use them, and so forth. But those who attacked the German lines on the 1st July, 1916, will be surprised to read his denunciation of the time wasted on their construction—"during which the infantryman forgot how properly to use his rifle."

Readers of the *Journal of the Royal Artillery* will naturally want to know what so severe and so well-informed a critic has to say of the Gunners, and he has much to say. It will surprise field artillerymen to read that "the foot artillery had a better understanding of infantry situations than the field artillery." Very curious too is his opinion of ourselves. After extolling the excellence of the French guns and gunnery, he goes on :—"The Englishman was more cumbrous—plump—in his manner of firing. One could have walked round the point of impact of an English shell with reasonable assurance that every shot would strike approximately at the same point—to-day, to-morrow, and the day after"! How many of us said exactly the same of the Germans, and while admiring, and sometimes, I am afraid, envying the accuracy of their weapons, congratulated ourselves on our superior skill and imagination in the direction of our fire!

THE ARTILLERY OF THE AUXILIARY FORCES.[1]

The papers dealt with above, though in many cases of rather exceptional merit, have been of the character one might expect. Undoubtedly the most remarkable feature of the American journals for the last half-year is the enterprise of *The Journal of the United States Artillery* in devoting two complete numbers to the relations between that Corps and the National Guard and Reserve Officers Training Corps—corresponding to our Territorial Army and the Senior Division of our Officers Training Corps. This is breaking new ground, and it has special interest for us because of the great similarity between the conditions in the two countries. We both started with small Regular Armies and finished with the Nation in Arms, and we have both gone back deliberately to the small Regular Army. Before the War these "auxiliary forces" were not taken as seriously as they ought to have been, by either the Regular Army or the great mass of the population, in either country; now, in both, they have been given a definite place in the Military Organization. But there can be little doubt that their continued progress in military efficiency must depend to a great extent upon the understanding and cordial helpfulness of Regular Officers. Fortunately more and more of the latter are coming to see how much the Regular Army itself will be dependant in war upon the quality of the assistance they may count upon from the Auxiliary Forces, and that it is thus in their own interests that they should extend the hand of fellowship to the latter. The American organization, in which different corps and services have each their own "Chief", lends itself to such action, and the way in which they look after their own affairs is very striking. Thus, as has been told in a

[1] To revive a discarded term which saves here somewhat lengthy repetitions.

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previous article (*Journal of the Royal Artillery* page 293), an Association of all those who were engaged in the production of munitions during the War has been formed under the auspices of the Chief of Ordnance. The members are pledged to "Public Service in Effecting Industrial Preparedness for War"; a special journal is issued with the object of keeping them in touch with the progress of military science; and an annual gathering is held at the Aberdeen Proving Ground—the Shoeburyness of America—where the members are shown all the latest developments of artillery material, so that, should the need arise, they may be ready to take up their task again without delay.

In the same way the Chief of Coast Artillery, recognising the peculiar difficulty of obtaining suitable reserve officers[1] for his Corps, owing to the necessity for some scientific knowledge, has inaugurated an annual gathering at Fortress Munroe—the School of Gunnery—of all Coast Artillery officers doing duty with the Reserve Officers Training Corps. At this gathering individual experiences are compared, difficulties discussed, and recommendations for submission to the Chief agreed upon. It was at the suggestion of this gathering that it was decided to devote a number of the Journal exclusively to R.O.T.C. work, so as to focuss the attention of Coast Artillery officers on this new and important development of their work.

The idea underlying the issue of a National Guard number is the same. But I can not do better than let the Editor give his own reasons :—

(1). It is high time for the Journal to concentrate on each of the elements of its problem, and thus aim for more definite results.

(2). The National Guard is now one of the most important elements of the Coast Artillery service.[2]

(3). It is thus needful that Regular and National Guard Coast Artillerymen should know each other better.

(4). The National Guard Coast Artillery has the right to be convinced that the Journal is for and of the National Guard as well as of the Regular. It is thus hoped to pave the way for a more general and continuous participation of National Guard officers in the discussion of Coast Artillery problems.

Put *Royal Artillery* for *Coast Artillery*, and *Territorial Force* for *National Guard*, and does not the above reasoning apply with equal

[1] During the War some Corps maintained regular propaganda at the Univerities. Likely men were personally communicated with as they became liable to the draft, induction papers were obtained for those willing to join the Corps in question, and every step taken to facilitate their qualification for commissions.

[2] By the National Defence Act of 1920 the establishment of the National Guard has been fixed at nearly half-a-million, including the following Coast Artillery units:—

122 Companies.
10 Anti-Aircraft Regiments.
4 Anti-Aircraft Machine-gun Regiments.

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cogency in our own case? That such special numbers need not be uninteresting to the general reader, will be readily admitted by anyone who will read those under review. Even if we could not afford the wealth of photographs of palatial "armouries", and if the conditions in our smaller country are less varied, our officers who have had experience of duty with the Territorial Force or Officers Training Corps must have much to tell that would be of value to all. And how much Territorial Artillery Officers could tell us of their experiences when called upon to take their places at the front, side by side, with their comrades of the Regular Army!

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PACK ARTILLERY.

THE WEAPON OF ACCOMPANIMENT.

BY MAJOR T. C. LEAH, D.S.O., R.G.A.

PART I.

PACK ARTILLERY IN THE GREAT WAR.

LIGHT Artillery pieces, carried on mule back, but of sufficient precision to support the attack of infantry, were, before the Great War, known as Mountain Artillery, and only existed in India and Egypt. "Field Artillery Training," 1914, refers to them as follows, "In country where wheeled traffic is impracticable, light guns carried on pack animals are the only substitute for field artillery . . . . Pack animals can go practically anywhere that an infantry soldier can go without using his hands, and batteries of mountain artillery are peculiarly suited to work with infantry in difficult country of any kind." In fact mountain artillery was considered as light field artillery,and its tactical handling and training were entirely on field artillery lines; no special consideration was given to close support problems. They had a monopoly of frontier warfare, and on account of this and of their fine traditions and great *esprit de corps* (vide Rudyard Kipling) they had a privileged position in the garrison artillery, and officers and men were specially selected for their service. This system died during the war, and is again in force to-day.

On the outbreak of war in 1914, one brigade proceeded to France with the Indian Expeditionary Force A. They were intended for the close support of infantry and their name was changed to pack artillery. They were re-armed with the 2·75 gun, an unsatisfactory weapon, deficient in shell power. There was little time to think out new problems, and they unfortunately did not arrive in the front line until December, 1914, by which time it had been stabilised and the opportunities for offensive action were few and far between. With the advent of the trench mortar they found themselves crowded out, between the greater power and suitability for trench warfare of that weapon on the one hand and the superior ballistics of the more powerful field gun on the other. In fact they were found unsuitable for static warfare, and at the end of 1915, were sent to Salonika for work among the roadless hills of Macedonia being joined there by a Highland Brigade which had come from Gallipoli.[1]

Here again they were unlucky; no serious operations took place before August 1916, by which time position warfare had again set in, and after a period of "Archie" work they were sent to a quiet hill

[1] Pack artillery did magnificent work in Gallipoli, but it is understood that as more and more field artillery and trench mortars were disembarked, the limitations of the pack gun in static warfare were discovered as they had been in France.

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sector where no serious operations took place. In the autumn of 1918, when the Bulgarian front broke, they did some remarkable hill climbs, but difficulties of supply stopped both them and the infantry they supported, from following up a demoralised enemy.

Mountain artillery kept up its prestige in India and Mesopotamia, in Palestine,[1] Persia and Gallipoli, but among the millions of our 1918 army, there were comparatively few who had knowledge of its successes and prowess in those theatres of war. The result was, that by the end of the war, field and heavy artillery were popularly considered as the only branches that counted, and horse and pack artillery were somewhat discredited for future great wars. Pack artillery, in particular, had not made good, and was held to be only of value in hill warfare.

Some surprise was shown therefore, when after a wholesale demobilization in India, eight batteries (reduced from 16 by the Geddes Axe) were re-formed with British personnel for service at Home, and simultaneously, medium brigades were reduced almost to their pre-war dimensions.

Some held that this was a retrogade movement and contrary to war teaching. It was not considered by these critics that the mountain gun had a flat trajectory and slow rate of fire and that in action it was merely a very inferior 18-pr. If it attempted to get close up it had to come into action in the open where it was likely to be annihilated by machine guns and gun fire. To live near hostile machine guns the artillery weapon must have a curved trajectory so that it can take cover. The introduction of such a weapon, the 3·7″ howitzer, entirely revolutionised the possibilities of pack artillery, and these notes have been penned with a view to discussing the reasons which make its presence, for use as guns of accompaniment, essential in the Field Army of to-day and to consider whether its present training, organisation and equipment are the most suitable to enable it to carry out its role both in close support and for ordinary artillery work.

It is suggested that the best way to deal with the problem is to consider :—

(a). What the infantry want that field artillery and trench mortars as organised on their present basis, cannot give them.

(b). Why, guns of accompaniment being necessary, pack artillery is most suitable for the purpose.

(c). The characteristics, organization and equipment of the pack artillery of to-day and what alterations are necessary to meet infantry requirements.

(d). To supplement the article by "Notes on the minor tactics and co-operation of guns of accompaniment with the infantry."

Note by Editor.—This second article will appear in "The Journal of the Royal Artillery" for December.

[1] Pack artillery was successful in Palestine with the 3·7″ howitzer, unsuccessful in France and Salonika with the 2·75″ gun. It must be a matter of opinion whether they would have failed in these two Theatres had they been armed with a modern weapon, even under trench warfare conditions, the most unsuitable for their employment.

End of Part I.

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PART II.

INFANTRY REQUIREMENTS FROM CLOSE SUPPORT GUNS.

It is rather presumptuous for a gunner to be dogmatic on the question of what the infantry want. The writer's only excuse is that during recent combined training in the Aldershot Command, he has had the good fortune to hear the views of a considerable number of Guards and infantry officers of all ranks and believes that they would be generally in agreement with the following statement of their requirements.

(a). Anti-Tanks.

First and foremost is the question of anti-tank work: Infantry have no weapon for dealing with the tank: Rifle and machine gun fire may annoy, but can never stop a tank attack. They want somebody to deal quickly and effectively with their enemy. They want the immediate action of something, either friendly tank or anti-tank gun to restore the situation.

Artillery at a distance will normally be unable to interfere effectively owing to:—

(a). Difficulty of hitting a moving target by indirect fire.
(b). Difficulties of observation and communications.
(c). The difficulties, where both sides possess tanks, of distinguishing friend from foe.

Trench mortars will have little value on account of their curved trajectory, inaccuracy, and difficulties of ammunition supply: Light Stokes Mortars have no material effect on a tank unless they strike the track, and their moral effect is stated to be small. If artillery is to intervene efficiently it must be in the form of close support guns moving near the infantry and in close touch with the battalions to whom they are temporarily attached.

(b). Enemy Machine Guns.

Second only to the tank question is that of enemy machine guns, especially during the attack. In the latter stages of the Great War, in fact throughout 1918, enemy machine gun fire was kept down by the creeping barrage, and extreme concentration of all natures of artillery. As such an antidote will certainly not be available anyhow at the outbreak of the next war, the infantry want some means devised to identify and knock out machine guns, as and when they come into action. During recent manœuvres astoundingly good results were obtained by close support guns at these targets, but in war machine guns are not represented by large white arrows, neither do their detachments wear white hatbands and walk about on forward slopes in defiance of enemy fire. But, allowing that in war the identification of machine gun posts will be increasingly difficult, it follows that for their identification observation will have to be closer and closer (i.e. within 800 yards). The observers knowledge will be useless to himself personally, unless he is in touch with his gun, long lines of communication are impracticable in open war (not satisfactory in any kind of war) and therefore the gun or guns which he is directing must be close up. (See A.T. Vol. III. p. 89).

Note.—Infantry Training is curiously silent on this subject.

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In defence the problem is similar, but not so difficult since the enemy must move his guns up into position and is more easily identified while doing so. Trench mortars, on the defensive, may reasonably be expected to have ammunition dumped alongside of them, and should therefore be able to deal with targets up to 700 yards (see Infantry Training Vol. II. Appendix). In the attack the ammunition is not so likely to be available : One rather gathers most battalion commanders are shy in allotting men to carry trench mortar ammunition, and prefer to keep them for fire purposes.

(c). Attack and defence of selected localities.

In spite of "soft spot" tactics, attacks have not infrequently been hung up by the determined resistance of strong points, whence machine gun fire sweeps avenues of approach and ground in the vicinity. The natural weapons for employment against such places are trench mortars, but they may be short of ammunition, their limited range makes it difficult to get them sufficiently far forward, and they may not have sufficient power. There is usually insufficient time to arrange for the covering fire of ordinary artillery onto so small a target, and one on which direct observation is necessary. The infantry require a call on something more immediately accessible, and guns of accompaniment of good shell power may be invaluable.

Everybody will remember that during the 100 days advance in 1918, artillery was almost universally, completely silent at the end of the creeping barrage, the reason being that the situation was so mixed that it was impossible to distinguish friend from foe. The only people who could intervene were the close support guns, and quite frequently they were unable to do so through inability to clear intervening obstacles, or even their own infantry, on account of their flat trajectory.

(d). Morale.

The moral effect of an artillery weapon of accompaniment firing from close behind our own infantry, and bursting with a good "plop" in enemy country is, I am assured, considerable. For this purpose, and as a rallying point, close support artillery is welcomed. There is the disadvantage to be considered that in the event of a withdrawal, artillery must retire before its covering infantry leaves their position, and the moral effect of such a retirement is bad.

* * * * * * * *

The tank expert is inclined to say that his arm is the most efficient to support the infantry in all these four aspects. His guns, will be the quickest to knock out hostile tanks, silence hostile guns and machine guns, and to keep them silent. As Tank Training quaintly puts it, "A gun can be damaged and put out of action for a considerable time by a tank passing over it." His tanks, with their extreme fire power, are the most reliable assistants in the attack on strong points, and their moral effect can hardly be over estimated by any who has had the good fortune to advance cheering behind them.

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But the tank suffers from its vulnerability to shell fire, its delicacy of mechanism, and the difficulties of seeing out of it when closed for action. Moving at night, even when opened up, it is a dangerous companion. Tank Training remarks, "It is necessary for a guide on foot to lead each tank. The driver of the tank must be careful not to overtake the guide." Obviously.

What the New Arm may become nobody can say: But at the present moment it cannot take the place of light artillery: Both are necessary.

End of Part II.

PART III.

WHY (GUNS OF ACCOMPANIMENT BEING NECESSARY), PACK ARTILLERY IS BEST SUITED FOR THE PURPOSE.

To fulfil infantry requirements it follows that one of two alternatives is necessary, or better still, both. These alternatives are :—

(i). The provision of tanks to accompany the infantry and to be attached to battalions.

(ii). Light guns in accompaniment and under the orders of the battalion commander.

The first alternative is ruled out by Tank Training. This lays down (page 84) that, "Special tank organization must never be broken up: the smallest fighting section that can be detached is a section (4 tanks)," and further on "Tanks will not be spread out in small numbers along a broad front. The maximum effect from a given number of tanks and the greatest assistance to the infantry, is obtained by concentrating tanks, organized in depth and with adequate reserves, in considerable numbers against the most important objective." Infantry therefore, must not expect tank support for general purposes, but only on special missions. This is recognized and emphasized in Infantry Training, Vol. II. (Sec. 59).

There remains the second alternative: It is now generally accepted that close support guns are both desirable and necessary, and that, to use an Irishism—these guns should be howitzers, so as to be able to take advantage of cover at short ranges. They must be inconspicuous, extremely mobile, but as infantry guns, their pace of manœuvre need not be greater than a walk. They must be pieces of precision and of sufficient range and shell power to be used as ordinary artillery under the orders of the C.R.A., if so required.

The pack artillery howitzer fulfils these conditions; it can be used as easily in draught for a short distance as in pack, and can go practically anywhere that infantry can go without using their hands. It is extremely accurate, shooting very much better with low charges than the range table indicates. Its inconspicuousness was especially noted on recent manœuvres. An officer who was observing from a kite balloon immediately over the operations area stated that the difference in visibility between the field gun and its six-horse team and limber, and the pack gun with its five animals—two pulling the

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gun, three carrying ammunition—was enormous, and that the latter, moving inconspicuously across country, did not appear worth while for an aeroplane to bomb, and was not identified as artillery until it had disappeared behind cover and opened fire with blank. My own battery umpire, an officer with great war experience of close support, was of the same opinion (see "Artillery Training," Vol. III. Sec. 55 (4)).

It may then be assumed,

(a) That the infantry require an artillery weapon to assist them against hostile tanks, machine guns and strong points.

(b) That pack artillery, armed with the 3·7″ howitzer is the best suited to give them this support, and is able to do it.

Note.—There is a parallel line of thought in the French army on this subject. See Genl. Evans's lecture, "R.A. Journal," December, 1921, page 353.

End of Part III.

PART IV.

THE CHARACTERISTICS, ORGANIZATION AND EQUIPMENT OF PACK ARTILLERY, AND ANY CHANGES NECESSARY TO MEET INFANTRY REQUIREMENTS.

A pack brigade, as at present constituted, consists of three batteries of 3·7″ howitzers, and one battery of 2·75″ guns the maximum range of each being about 5,800 yards. "F.S.R." Vol. II., lays down their characteristics as under :—

Characteristics.

"Pack guns (2·75″)" are the weakest in shell power. They are peculiarly suited for operations in close, broken, or hilly country. In level country they may be moved with comparatively little exposure, owing to the facility with which they can take advantage of cover. They can therefore often be made available for use in support of infantry at shorter range than either horse or field artillery.

"Pack howitzers (3·7″)" are the weakest in shell power. In hilly or very enclosed country they are invaluable for the close support of infantry where any form of gun, owing to the flatness of its trajectory, cannot be used "; and it adds also, on page 27, "one of the most important duties of light guns is anti-tank defence. These guns are the most effective weapon for the purpose.

The howitzer fired with full charge at ranges of 1500 yards and under, has a reasonably flat trajectory and a greater striking impact than the 2·75″ gun. With the 106 fuze E, it may reasonably be expected to penetrate a modern tank at such ranges. The pack gun owing to its limited traverse, is not suitable as an anti-tank weapon.

Organization and Equipment.

All batteries are on a four gun basis and are based on the principle that every article is carried in Pack. Mobilization tables are also framed from this standpoint, and are obviously copied from those

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now in force for mountain artillery in India. The total number of mules allotted for each howitzer battery is 152 of which 8 are required for each gun and 11 for its ammunition. This large number of animals is essential on the Indian Frontier where roads are non-existent, and the whole force is on a pack basis, but is unnecessary in ordinary country where the transport of the rest of the force works in draught, up to and including the three ton lorry. All that would appear necessary would be to keep the firing battery on a pack basis, and have everything behind that on some type of limbered wagon, drawn by 4 mule teams, such teams being available to replace casualties in the firing battery. By doing so the number of animals could be decreased from 152 to 100 and the ammunition supply increased to 150 rounds per gun.

The present pack mule carries an average of 340 lbs., including saddlery, on his back, which is the regulation load of an animal operating in the mountains of the Indian Frontier. These have to be small and stocky, so as to be sure footed on the khud, and to enable their loads to be easily taken on and off on steep and difficult hillsides. It is suggested that for work in Europe a larger animal equally suited to pack and draught could be used—for all loads other than top loads—and that such a one could carry a heavier weight, say 400 lbs. on his back. In this way each ammunition mule could carry 10 rounds instead of 8, and would improve the difficult question of ammunition supply.

At present guns advance into action with two ammunition mules, i.e., 16 rounds per gun. This is insufficient; three mules are necessary which it is hoped will bring up 30 rounds per gun. Mules when unloaded, proceed immediately to the first line, where they refill.

When the guns are in action the whole of the mules should be available for bringing up ammunition in pack from the wagon lines and will require ammunition hooks on each saddle for the purpose.

The ammunition is, at present, entirely H.E., fuze 106; a shrapnel shell is in course of manufacture and is to be issued. Those of us who have had experience of the 4·5″ howitzer shrapnel look upon its advent without enthusiasm. A special anti-tank shell and cartridge are also spoken of, to produce a higher M.V. and a greater striking impact against tanks; if the present shell with its present fuze, are not able to penetrate the sides of the modern tank, something of the kind will have to be brought in.[1]

The gun is able to move in draught, as well as in pack, and on favourable ground, is better manœuvred in draught, since it presents a smaller target and is more quickly brought into action. The draught arrangements are unsatisfactory, but are in process of alteration. Five animals are required to move the gun (with its ammunition) in draught, and ten in pack.

The pace of manœuvre is the walk; trotting can only be carried out for short distances—say 600 yards. Pack artillery is therefore not so suitable as horsed artillery for employment in a retreat in open

[1] In the old days of mountain artillery a case shot box containing four rounds of case was brought up into action for use in case of emergency. It would appear good policy to produce an "anti-tank box" to be used in the same way.

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country. In rugged and enclosed country its capacity to move by bridle paths and clear of all roads may outweigh this disadvantage. An example took place on recent manœuvres during a retirement scheme. When the time came to get away the battery covering the retreat had to cross a bridge, and that bridge was denied to it by enemy fire. No other bridge was available, but previous reconnaissance had discovered a footpath over a lock and the battery was passed over that, and completed its withdrawal unobserved.

Pack saddles are not interchangeable; if one animal becomes a casualty the load has either to be brought up by hand or else wait for the relief mule carrying the special saddle required. The provision of a universal saddle is desirable and necessary. Even if such a saddle was heavy and cumbersome and not suitable for universal use. one mule so equipped, and marching with the firing battery, would be able to pick up any load, and advance with it without delay.

At Home, nobody has a good word to say for the 2·75″ equipment, though it is still in demand on the Frontier. It is suggested that it should be put into store and all four batteries armed with the 3·7″ howitzer.

The requirements of pack artillery in normal country, and mountain artillery on the Indian Frontier are different. The primary role of the first is as a gun of accompaniment, the second is intended for ordinary artillery purposes over ground where heavier guns would be immobile. There is however, nothing in the proposal for equipping pack artillery as weapons of accompaniment, which could not readily be adapted for use in mountainous country.

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PROPAGANDA AND THE GUN.

BY CAPTAIN C. A. JARDINE, D.S.O., M.C., R.F.A.

DURING the war the 18-pr. gun proved itself a most serviceable weapon, as did the 4·5 How : the latter is described by the French authority on artillery, General Gascouin, as the best piece of its class to be used by any of the belligerents. The British gunner realized that he served a gun worthy of the British Infantry, and the pre-war training produced an admittedly efficient artillery, which was able to modify its methods, perhaps slowly on occasions, to suit the various forms of warfare. But the writer raises the question as to whether the infantry or the public, so important in times of war, were made to realise the excellence of the supporting arm.

Let a comparison be made with the French army. The "*soixante-quinze*" was the emblem of French military power. Every soldier, every man and every child was brought up to trust in the support of this gun against an invading army. Probably in England more people knew of the "75" than of the 18-pr. or the 4·5 ; certainly in the writer's opinion the majority of the British infantry believed that the "75" was an immeasurably better weapon than the 18-pr. This popularity of the "75" was, apart from its excellence, due to a judicious policy of propaganda. The gun was exhibited on all possible occasions, such as fêtes and reviews : photographs were printed and circulated as post-cards, and models were made as toys. Consequently the French nation in arms went to war with a supreme confidence in their gun : and this confidence only received a temporary set back in spite of admitted errors in training, in spite of the fact that for many months[1] their gunners failed to use the "75" at long ranges, and hence sacrificed counter-battery work and failed to get the best results from their H.E. shell : in spite of inevitable "shorts" falling amongst their own men and in spite of shortage of ammunition. These errors were remedied, reassuring pamphlets were distributed amongst the infantry and the gun lost none of its popularity. This faith was obviously a tremendous asset from a military point of view for a Nation in arms, and one great factor towards a high moral was assured from the outset and maintained during nearly the whole course of the war.

The writer is inclined to doubt whether the same happy state of affairs existed in the British Army. There appeared to be an absence of intimacy between our infantry and their supporting guns; and they lacked the absolute faith that the French had in the "75". The gun was more often referred to as "the artillery" rather than by the more intimate description "18-pr."

[1] Vide "L'évolution de l'artillerie pendant la guerre." By Général Gascouin.

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The question arises as to whether this comparative lack of faith was justified, whether the "75" was so much more worthy than the 18-pr. With regard to training, unlike the French, the British gunner was taught to use his guns in the defence, at long ranges and for counter-battery work. Our shrapnel shell was an excellent projectile; certainly we lacked H.E. shell; our shortage of ammunition was notorious. To compare the guns; the "75" was lighter and handier, perhaps more easily concealed: simple in mechanism and more steady in firing; but owing to its lightness and small factor of safety a considerable number of "75s." blew up, causing heavy casualties amongst the detachments. This occurrence was very rare with the more solidly build 18-pr. Owing to its steadiness and simplicity the "75" could fire at a quicker rate than the 18-pr. but experience has shown this to be of little advantage as, for various reasons, it was rare that a field gun was asked to fire at a rate of more than 4 rounds per gun per minute. The M.V. of the 18-pr. is 1615 f.s. compared to 1825 f.s. of the "75". The trajectory of the "75" is consequently flatter, but as Gascouin bears witness this did not always prove a blessing. So it appears that on the whole a 18-pr. gun, and its handling, bears comparison with the "75": yet, in the writer's opinion, its reputation was much less. Hindenburg in his book repeatedly draws attention to the devastating effect of the "75": even this effect on the enemy may have been partly caused by the French system of "suggestion".

If it is necessary for us to remain to some extent a military nation and, more important still, if the nation should again have to take up arms, it is certainly worth while to foster a spirit, within and without the Army, of complete trust in the gun that supports infantry in battle. Within the Army this can be brought about by such methods as lectures, by the policy now in vogue of keeping the artillery in mind and eye at field days, by demonstrations of fire, by increased numbers of attachments from the infantry to the artillery, by a cultivated spirit of confidence in the gun. Without the Army this spirit can be fostered by constant exhibition of the gun at shows and reviews, by cinema films of the gun in action and, perhaps the most important, by a deliberate policy of "writing up" in the press. Trade methods must be adopted to bring a good article to the public notice and propaganda, which proved so useful to us in war, must be made use of in peace time.

Perhaps a word of warning is here necessary. In the French army the lack of medium howitzers, felt so bitterly during the first years of the war, was attributed partly to the "75 fetish." No other weapon was considered necessary: propaganda had blinded the eyes of the French Army.

Moreover it might appear strange and incongruous if the methods suggested in this paper were suddenly adopted with the existing armament, which, though recently improved, has virtually been in use many years. It would therefore be wise to inaugurate this policy with the advent of the gun of the future, be it horse or tractor drawn.

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OPERATIONS OF THE HORSE BATTALION, 15th (GERMAN) FIELD ARTILLERY, WITH THE 7th CAVALRY DIVISION IN NORTHERN FRANCE, AUGUST, 1914*

BY LIEUT.-COLONEL A. SEEGER, GERMAN ARMY.

From *Artilleristische Monatshefte*, March-April, 1921.

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ON October 9th our 7th Cavalry Division was marching north in three columns towards the obsolete fortress of Lille, with orders to invest it from the west so as to enable the troops approaching from to east to take it readily. In the "race to the sea" it was important to be quicker than the enemy, and get possession of the great industrial centres, with their stores of supplies. Our cavalry under General von der Marwitz, with the divisions in the west, had the task of screening, of seizing and holding ground, and of working in the enemy's flanks and rear. All this it did successfully, and justified its existence even in these days of automobiles, tanks and airplanes. The long marches and the serious fighting, sometimes with and sometimes without infantry, reached their height with us in these days just before the taking of Lille. Without this work it would have been impossible to prevent the enemy from reaching the German exposed right flank before the lines became stabilized.

Lille had been abandoned in August by its garrison of some 25,000 men, because it was realized that it could not stand against modern heavy artillery, even less than the strong fortress of Antwerp, which fell on October 9th. However, several thousand territorial troops had entered the city in September, in anticipation of reinforcements by both French and English; their orders seem to have been to hold the vicinity of the city by field entrenchments, but to avoid bringing on a bombardment of the city itself. Wahnschaffe's small detachment was approaching from the east to attack the place, and our cavalry was to operate from the west. Six cavalry divisions in all were engaged along the line Bailleul-Bethune; one of them even got as far as Hazebrouck, where it had a mounted engagement with English cavalry.

Our division had learned that the French were trying to get as many able-bodied men as possible out of Lille, for service in their army. Our patrols reported that long columns of inhabitants, with transportation of every kind, were making their way westward escorted by territorials.

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* Translated by Colonel O. L. Spaulding, General Staff, U.S. Army.

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One such party we intercepted on October 10th. We had crossed the Deule Canal south of Lille on a broad front, meeting little opposition. As we approached the villages of Ligny and Beaucamps, our patrols came galloping back and reported a railway train full of infantry just entering the station at Bacde Wavrin. We were ordered to fire a few shots to drive off the territorials, who seemed to be a covering detachment. The leading piece of my 3rd Battery went into position at once, only 500 metres from the station, and opened fire upon the train, which was still moving very slowly, and whose crew and passengers seemed utterly astonished at meeting the enemy so soon. We had never had an opportunity to use a railway train for a target, at least at so short a range; so, in spite of all the familiar "movies" on the long ridge at Jüterbog, which generally moved much faster than this train, our first shots at the locomotive went wide, although the cannoneers worked feverishly to get on the fire target, and the young officer in command of the piece ran up and down in excitement, shouting "Fire! Fire!" to urge them on. Finally he got something like a bracket, and was about to fire a volley at his enormous target, when he had to stop to avoid hitting our own dragoons, who by this time had reached the train. The passengers scattered in every direction.

We then went on to Ligny and Beaucamps. Our Strassburg Hussars now encountered a column of perhaps a thousand men, mostly civilians, moving from Lille towards Fromelles, with two companies of territorials and a few curiassiers ahead and a long wagon train behind. The commanding officer of the Hussars, who had held the command only a few days and so was full of energy and enthusiasm, decided to attack and capture the whole party; but first my guns were called upon to speak a word to the escort. Lieutenant von Chappuis, who was in the lead, put two pieces in position, and fired several effective shots at the head of the column, which at once scattered. The cavalry then closed in on the mass and surrounded them. Here, unfortunately, some of our own men were hit by shrapnel, and there were many complaints; it was entirely unavoidable, however, in this close country, unless one wished to give up the idea of artillery support altogether, which would have certainly caused us to suffer considerable loss from infantry fire. As it was, the success was instant. The prisoners were taken to Beaucamps, checked and examined. The losses among the escort were light; among the civilians, zero. The column was on the way to Dunkirk and Gravelines; it included a large number of vigorous men between 40 and 50, who had not yet been called to the colours, but who were now needed to replace the large French losses. Many of them were well pleased, so simply to avoid dying for their country, and did not hesitate to say so. There were also many foreigners and neutrals, and many who claimed to be such—Belgians, Danes, Spaniards, and even a few Germans, who now decided that it was their duty to reveal their true nationality. In the wagons were many women, who had preferred to accompany their husbands or who had taken this opportunity to get out of the danger zone—a very sensible decision, in view of later events at Lille.

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The Maire of Lille, very wisely, had issued a proclamation, warning the people against any hostile acts toward the enemy's armed forces. Everyone was advised to give quarters and subsistence without resistance, and avoid any act calculated to bring retaliation upon the city. This proclamation, posted at all the road crossings, contrasted sharply with those of the Belgian cities at the beginning of the war. How much bloodshed would have been avoided if the civil population everywhere had taken the attitude prescribed by the Geneva Convention!

The garrison, however, made a useless resistance with weak forces under the walls of the old fortress, which caused a bombardment of the city. Here also, a little co-operation between civil and military authorities would have avoided a loss running into millions, which we now have to pay, the enemy charging their own faults to our account.

About this time—I believe on the 10th—a young officer was sent from the Division Intelligence section, without escort, to Lille, with instructions to take possession of the telephone and telegraph offices. As a matter of fact, Lille was still occupied by the French; and as his car drove peacefully through the suburb of Haubourdin it was fired upon by French soldiers. Seeking to escape, he drove at random through the streets, and finally got into a blind alley. The driver was killed; the officer sprang from the car and placed himself under the protection of a French officer, explaining his mission and his ignorance of the true situation. A crowd of soldiers and civilians collected, shouting "*à la mort*" and "*à la lanterne*." But in this case, in contrast to many other cases, the French officer did his full duty, and brought his prisoner safely to the citadel, where he was held for a few days, until the city was fully taken over by the Germans. When the citadel finally surrendered, with its garrison of 3,500 men, this officer was able to repay the kindness of his hosts, especially the chivalrous commandant, by rendering various services. In recognition of this, when the commandant was sent away as a prisoner of war, he gave his two very good horses to the German officer, who later made a full report of his experiences.

On the 10th our division rested at Fromelles and Fournes, between Lille, La Bassée and Béthune. In front, we were in contact with new forces of the enemy; in rear, strong reinforcements were coming up to relieve the cavalry, and to construct a new fortified position under the old walls, where an attack in force could be sustained. On the main road between Armentières and Béthune, we met regular English infantry which prevented any further advance. Our cavalry was not equipped for small operations against infantry; our dismounted skirmishers had little fire power, no bayonets, few entrenching tools, no grenades and no wire. Under fire, they could only take cover and try to hold the ground they had gained. Our opponents were good shots, made skilful use of cover, and could hardly be found even by my artillery observers. We were very glad, therefore, to be relieved by infantry—two battalions of the 112th Baden Infantry, from the Aisne front. As already remarked, the presence of infantry always gave strong backing to our operations; we artillerymen were always pleased to have them with us. The

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infantry does not begin to think of the led horses when things get hot; but is always mindful of the duty of the foot soldier, to attack or hold his ground.

The fighting at Richebourg and Neuve Chapelle brought us many anxious hours and many losses, but also many successes against the English Royal Fusiliers. The work was especially difficult for my batteries on account of the difficulty of getting observation in this Flemish country, so that my guns, only twelve at best, could get little effect. It was impossible to work the battalion as a unit; from the advanced observation stations, only limited areas could be seen, and it was rarely possible to bring a cross-fire upon neighbouring areas. The attacks of the enemy often brought partial successes, endangering even the adjoining parts of the line which were not attacked. Our higher commanders gradually came to the conclusion that it was necessary to work the guns closer and closer to the line, even into it, a measure which was not popular. The cavalry and infantry complained that the guns drew hostile fire upon them. But the higher cavalry commanders ordered peremptorily that the artillery should share in the dangers of the close combat; so, between the two opposite views, it was hard to find the right tactics. One of the highest cavalry commanders went so far as to say that he would not be satisfied until the last gun was put into the skirmish line. As artillery commander, it was my duty to point out that in the face of an energetic enemy, as was the case here, in case of a counter-attack the guns would certainly fall into his hands, while infantry and cavalry would fall back quickly. In spite of the contradictory demands upon them, the scattered platoons and sections were skilfully handled, and helped out in many close combats—making a virtue of necessity, for the guns could not be got away, either with the limbers or by hand.

Such changes in tactical conceptions we should never have believed possible. I think we should all have been stoned if we had taken such risks with our guns in manœuvres or service practice. But fortunately the enemy could not get up his courage to make a determined effort to break through our thin lines. Evidently he did not know how weak we were; and then of course his own artillery was working under the same disadvantages as ours. It was soon evident that his fire was chiefly at random, or only by the map. Our losses, consequently, were slight; we had only one gun destroyed by fire, although a few were temporarily put out of action. The numerous scattered buildings, however, drew heavy fire, the enemy of course assuming that we were using them for shelter or observation.

On Sunday, October 11th, we were cautiously approaching the Estaires—La Bassée road, to reconnoitre and take up position. Our cavalry was halted at a cross-road, near an inn with the striking name "Estaminet de la Bombe." I was sitting by the road, with the commander of the advance guard brigade, Duke R——; the sun being warm, he was dozing, while waiting for a report from the front. At that moment an automobile came dashing up, and out stepped the cavalry commander of the whole west front, like Jupiter Tonans, looking upon the peaceful scene so sharply that I felt impelled to

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give the duke a more or less disrespectful nudge to bring him to attention. His Excellency von M—— was pleased to make ungracious comments upon the apparent inactivity, to which it was hard to make satisfactory replies; the brigade adjutant was absent, and His Grace was still a trifle bewildered with sleep. The cavalry commander finally wound up his little speech by saying, "Here we are lying about the road, with enough cavalry assembled to get clear into the enemy's rear, as His Majesty positively ordered yesterday. So, gentlemen, get to business at once!" Just then an English "Sugarloaf" struck with a terrible explosion fifty paces from us. The moral effect was surprising. Someone of our guests shouted, "Thunder, there's something doing here! Chauffeur, turn around." In an instant the whole cavalry corps had disappeared, leaving it to us to decide how to "get to business."

The next five days were hard ones for us. Never before had we had so difficult and important tasks. Only a realization of their importance, and an iron sense of duty, enabled our officers and men to hold out, when the situation often seemed desperate, and especially when one day the division next us thought its flank was turned and fell back. The cavalry commanders of every grade on this occasion set a fine example of devotion to duty, as did also the commander of my right flank battery, Lieutenant von Chappuis. Although the right flank at Rouge Croix was evidently exposed, he did not obey the order, erroneously sent him from the right, to fall back, but when he saw his guns limbering up put them back into position and kept up the fire upon the enemy who was working around the flank until night. With his guns stood the skirmish-line of Queen Olga's Dragoons, under Captain Schmetzer, and held the line of the Estaires —La Bassée road. Several observers were wounded in the little red house on the road, upon which the enemy fired repeatedly, including finally Captain Schmetzer himself. As he was being carried away on a ladder, under fire, he called out to the men to save their cartridges and wait for close range. A final attempt by the enemy to reach the road, just at nightfall, was repulsed by the fire of the guns and a few remaining carbines.

On this evening, the 14th, the situation was so strained that it was evident that a decision must come the next day; before long the enemy would envelop our right. But our orders were positive, to hold the line. The enemy saw that we were not merely making a demonstration, intending to fall back, but that we meant to fight for it. It was essential to hold this line until the one in rear was ready.

During the night there was some little firing, probably of no importance, in the outpost lines at Richebourg and Neuve Chapelle. The nerves of our men were overstrained from lying so long under fire with little cover, and so the firing spread all along the lines and continued until midnight, costing us an immense amount of ammunition to no purpose, for the enemy did not attack. This is a very common experience, and a thing against which all subordinate commanders must always be on the watch. This fighting on foot and at night was then a new thing to us, although in the east the cavalry was already expert in it.

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Finally, early in the morning of the 15th, we were relieved. We were too weak and too inexperienced in such fighting to stand against regular infantry, which daily astonished us by their skilful use of the ground and by their accurate shooting. Thus we noticed that the English would creep close up to us through the tobacco fields, by winding their bodies with the long half-dried leaves. We at once imitated this trick; we were learning something every day that was not in the books. One such English trick cost some of our scouts dearly; cattle were still numerous in the fields, and the enemy had been making use of them as a mask, like Odysseus in the cave of the Cyclops, and thus reaching desirable points. When our men tried it, however, three of them were killed; as the proverb says, everyone looks behind the bush where he has hidden himself, and the English were evidently watching for us.

We captured few prisoners during these October days; but those that we did take impressed us as more reserved and less worried about their own fate than the French. They showed much more confidence in ultimate victory than their allies, too. One of them, when asked about his capture and his ideas of the prospects, said, "No matter. If I am captured to-day, there will be ten more in my place to-morrow. It's hard luck for me, but King George has plenty more Tommies." One sergeant made an especially good impression. He was every inch a soldier, full of national pride. His invariable answer was, "One has to fight, sir." His chief worry was that he could not present himself smart and clean when called in for examination; he would give no information.

We withdrew from our positions on the morning of the 15th. There was many a sigh of relief from our men when they got out of the fire-swept zone and, after their long fight on foot, mounted once more, even to move to their next quarters. The next day the English found us gone, but when they tried to follow they met infantry fire from a strongly organized and occupied new position, under the walls of the old forts of Lille. The 13th Army Corps had come with one division from the Argonne, and gave the English a warm reception.

Our division was given three days rest in the outskirts of Lille. The city had fallen into our hands on the 12th, and we utilized this opportunity to visit it, and to make needed purchases. The city was full of German troops of all arms, chiefly cavalry. Except for a few burned areas in the heart of the town, everything was much as in peace time, especially on the outer boulevards.

The city had to pay a contribution, which, however, was moderate in view of the wealth of the town. Paper money was hastily printed for this purpose, and passed freely. The people preferred it to German silver or even gold, for they believed our occupation would be brief. Neither the French nor ourselves would have believed that we should remain there four years, establish a German newspaper, and have German theatrical troupes play long engagements in the City Theatre.

There was little to be purchased in the clothing and provision stores. So many German soldiers had passed through that field

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glasses, boots and warm underclothing had been bought or seized. There was plenty of women's clothing, as the shop girls assured us. An experience of my own indicates the care taken by the German authorities in northern France. I had lost my raincoat, and got a civilian coat here, signing a receipt for it with my full name, a formality which unfortunately was not always observed. Two years afterward in Galicia my receipt came to me for redemption. I paid the specified sum 100 francs, equivalent to 81 marks, at the existing rate of exchange. Three months after, on the Rumanian border, I received five marks back, on account of change in the rate!

About October 20th we left our quarters here, marched through the city by brigades, and went north by way of Quesnoy to Comines on the Lys. Here we went into line opposite Zandvoorde, to learn the ways of position warfare, and to prepare for the great battles of the new reserve troops on the Yser.

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PACK ARTILLERY, THE WEAPON OF ACCOMPANIMENT.

Notes on the minor tactics and co-operation of guns of accompaniment with infantry.

BY MAJOR T. C. LEAH, D.S.O., R.G.A.

ARTILLERY Training Vol. III, Section 55, deals with the close support of infantry, but the author obviously had field artillery in his eye, and his style was cramped by knowledge of its visibility and vulnerability to machine gun fire. He probably had experience of this in 1918 when howitzers were never used, and guns had to come up onto the crest. The writer was commanding an 18-pr. battery at that time, and found that 20% men and 30% horses was not an unreasonable percentage of casualties to expect, on any day when a close support section went out. Orders were received late in the day, there was no time for liaison with battalion commanders, and the guns proceeded on rather a roving commission, and usually without great success. This was true of Army Brigades, but Divisional Artillery had better opportunities for liaison and co-operation, and probably made better use of them.

The lessons the writer personally learnt from those operations were that no gun should be committed to action without a definite target to fire at, and that (unless firing at artillery) a single gun for a single task was sufficient, reduced casualties, and allowed a reserve to be kept in hand. Two officers are necessary in each section, and as Pack Artillery is to have four subalterns per battery this number can be allotted.

The greatest difficulties officers in command had to contend with were in the identification of targets, and in assuring themselves that such targets were enemies and not friends. Even in the Somme country, the experienced infantryman found the spotting of enemy machine guns a difficult job, and the gunner had to go extraordinarily close before he could identify them. It was hard to obtain reliable information : until one has tried it, one can have no idea how hard it is to get news out of a tank, closed for action, full of fire and fury, and quite ready to run over a P.B.I. under suspicion of his being a camouflaged Hun. The writer knew an officer once, who got in front of a tank and held up his arm like a policeman to have a chat with it. The results were unfortunate—but that is another story.

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Information was obtainable, if one worked for it, and walked for it, and fought for it, but it did not grow on every bush, and officers who were not prepared to take risks did not obtain it. Nothing but the very best of leading was good enough for the gun of accompaniment, and if the leading was not there, then the gun did not pull its weight and was not worth while.

So much for war training: one can do things in a more leisurely and a more comfortable fashion in peace. Possibly minor tactics are more profitably and thoroughly studied during peace, and the following remarks based on experience gained during the combined training carried out this year (1922) are offered as a basis for discussion on a very difficult question. They refer entirely to problems of the attack: in the defence, except in exceptional cases and for the protection of special localities, pack artillery are best utilised under the orders of their artillery commanders, who will co-ordinate them in the general artillery scheme. Machine guns are usually brigaded in defence so as to obtain full benefit out of cross fire: it would be a reductio ad absurdum if pack artillery were not to be similarly controlled.

The usual strength of artillery allotted to a battalion is a section. It may, on rare occasions, be a complete battery, and, very exceptionally, a single gun. For convenience, the officer in command will always be referred to as the Battery Commander. Three officers will be available in each section: the major and two subalterns in one, the captain and two subalterns in the other. The efficiency of the whole will depend upon the efficiency of the battery headquarters from which each section radiates. It is suggested that this should be under the personal supervision of the Major, and that a second captain should be posted to each battery on mobilization, to complete section organization. The major will then have a spare eye for each section, watch over them, and be ready to smooth out any difficulties that arise.

(a). Preliminary reconnaissance.

In the preliminary reconnaissance before attack (Infantry Training page 67) the battalion commander is usually accompanied by his battery commander as well as company commanders and machine gun officer. The battery commander has the benefit of listening to the verbal orders and tasks given out to each officer, at the end of which the battalion commander will usually turn round and say, "And what about you, what can you do to help us?" This plan has many advantages but is open to criticism: the battery commander may wish to reconnoitre other ground which has not been passed over, and may have a difficulty about formulating his plan without doing so: on the other hand, he may not wish to, or, by consideration of time may not be able to hang up the final plans while he completes his reconnaissance. He may therefore, formulate a suggested line of action which is only half baked in his mind.

It is suggested that it would be better if the battalion commander gave his battery commander the outline of his orders, his probable

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plan and any other instructions he may consider desirable, at the very outset, tell him to do any reconnaissance necessary, and to meet him (the battalion commander) at such and such rendezvous at such and such a time. The battery commander taking another officer with him and a horseholder, could then get full advantage out of his horses (if the situation permitted) and on arrival at the rendezvous, and after learning from the battalion commander the course of action decided upon, would be ready to suggest a plan in accordance with infantry requirements.

(b). The decision.

The battery commander will say to the battalion commander something after this fashion, "I would propose to move one gun in touch with and on the left of your support company, where it will get better cover and will be able to help your left company especially. The other gun and ammunition wagons, I would propose to keep behind your reserve company. I myself, will accompany your headquarters."

Battalion commanders are of three kinds: the first listens to what the battery commander has to say, considers it with a view to the general situation, and decides accordingly. I would suggest this is the correct standpoint.

The second listens to his battery commanders report and says, "I leave it to you: you are the expert and you must decide. Do what you think best." This, to my way of thinking, is not so good; the battery commander is not the person to decide, but to propose. He only sees one side of the medal.

The third type of battalion commander does not ask for the opinion of his battery commander, but gives him definite orders as to where to place his guns and what to do with them.

This is undoubtedly a bad method, as it fails to take advantage of expert opinion. I have not personally met this third type, but I am told that he exists. Any attempt to place guns under the orders of a company commander is bad, and ought to be suppressed, except in very exceptional cases. So long as the battalion knows its gunners and trusts them—and vice versa—no friction or any question of hard and fast orders or their interpretation is likely to arise.

(c). Two guns or a single gun.

There is an old gunner maxim that "One gun is no gun". True as this statement is for all normal conditions, it is suggested that the quick firing weapon moving in close support, is the exception that proves the rule. I believe (but can find no evidence but my memory to verify the statement) that General Wardrop, then Major General, Royal Artillery, 3rd Army, issued an instruction in September, 1918, permitting single guns instead of sections to be sent out in close support if conditions rendered such a course advisable.

There is no doubt, to my mind, that a single gun, working alone, has more than double advantages compared with the section, both with regard to its manœuvre powers and its visibility. It is so incon-

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spicuous that, if seen, it would rarely be identified as a gun, and the men and animals of which it is composed can quickly and easily extend or close to either flank when crossing dangerous ground. When in action its fire power is sufficient to enable it to engage a definite target, such as a machine or anti-tank gun, (the purpose for which it is intended) and provided it has sufficient ammunition, there is no reason why it should not be able to fulfil any definite single task allotted to it.

The subaltern in charge of the gun would have a staff of two signallers and three runners, each signaller equipped with flags, telephones and $\frac{1}{6}$th of a mile of wire : this gives the officer a radius of 600 yards for establishing his observation post, and should be sufficient for all practical purposes. One of the runners would be the wagon line orderly, the others available to replace signaller casualties, and to take messages to the battery commander and company headquarters.

When the second gun is committed to action it should, if the situation permits, be brought into the area, but not too near to the first gun. This facilitates communication and ammunition supply, but does not put all ones' eggs in one basket : when the enemy's defence is breaking and pursuit is to be pressed, the section should be again concentrated, the second subaltern automatically becoming a gun position officer.

In single gun tactics numbers One will have to do the battery leading and the laying out of the initial line of fire; this will call for a high standard of training on their part, but there is no reason to suppose that they will not be able to attain to it. General Evans (R.A. Journal, December, 1921, p.p. 354 and 355) lays stress on the capacity of French gunner N.C.O's to do officers work, while Lieut. Warburton (R.A. Journal, January, 1922) translates two articles of General von Hippel's on the training of N.C.O's so as to obtain similar capacity. The lines he proposes appear to be equally applicable to British Pack Artillery.

(d). The position of accompanying guns, etc., during an infantry attack.

(Infantry Training Section 36 has a bearing on the subject).

(i). During the reconnaissance guns will be formed up in rear of the assembly position.

(ii). When forming his plan the battalion commander will frequently elect to proceed by bounds to the objective, or series of objectives, allotted to him. In open country the guns will probably be better able to support these early "bounds" from their original position, moving forward when the first objective has been taken. In very enclosed country they will be most valuable moving close up. I would suggest that the best location for the forward gun or guns is somewhere between the support company and the reserve company (normally about 600 yards behind the leading troops) and that the officer commanding guns should keep touch with the officer commanding support company, but should be free to

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move his gun in any way he likes provided he does so. Once he is in action it will be impracticable for him to keep touch with company commanders, and it will be their duty to keep touch with him if his help is required.

(iii). The rear gun or guns will move somewhere in rear of, but in touch with the reserve company, at not more than 400 yards distance. The officer will accompany his gun, but will send a runner to his battery commander who will accompany the battalion commander, and will be either with the support or the reserve company. (See Infantry Training Section II.) The battery commander, under instructions from his battalion commander, will send this gun into the fight when he thinks it necessary, for the purpose of—

(a) Reinforcing his first gun or guns.
(b) For a separate task.
(c) For leapfrogging through his first gun under cover of its fire.

(iv). The battery sergeant major or battery quartermaster sergeant will be in charge of the section ammunition wagons. They will proceed by bounds from cover to cover, keeping in touch with the rear gun or guns, having one runner with the battery commander and others with each separate gun. In most country it should be possible to use mounted men for manœuvre and control of wagon lines, and for communication rearwards from it.

(v). The battery commander will stay with the battalion commander until both his guns are committed to action: the latter should allow him a free hand to go away for a period to supervise the guns and inspect wagon line and ammunition arrangements. Generally speaking he should be with the battalion commander throughout the day.

(vi). After coming into action ammunition mules, under charge of the wagon line runner, will return to the wagons to fill up with ammunition: in the event of a further advance the wagon line will have to pick up empty boxes as they pass through the old positions. Firing battery mules will be assembled in close vicinity of their guns, in accordance with orders given by the senior soldier present with them.

(e). Anti-tank work.

This is the most difficult of all close support problems. Experience shows that to engage tanks with success they must be fired at over open sights and with full charge. Artillery Training Vol. III lays down (page 144) that, "Sections or even single guns may prove of great value in case of an atfack by tanks. Their positions must be carefully camouflaged . . . . and their value lies in their ability to deliver a sudden fire at comparatively short ranges. The guns should never be fired except in the case of an actual attack by the enemy." The writer

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is not quite easy in his mind on the subject for he adds (page 166), "This system is wasteful and unfavourable to control, etc."[1]

To engage tanks as soon as they appear guns must come up into the open, and be sited with a good field of fire, well camouflaged and remain silent until tanks appear. Once they open at any secondary target, however tempting, they will be doomed to destruction in the long run, either from rifle fire from a flank, or from artillery fire from under cover. If they do not open fire—and the odds are always against tanks coming up in any particular sector—then it is more than likely that they will suffer heavy casualties and accomplish nothing. The example of two anti-tank guns employed on recent operations is a case in point. The right hand one was well camouflaged and was not spotted by anybody, but no Tank attack came its way, and it was overrun by the attacking infantry without having fired a shot. The left hand gun had a fine field of view, but was easy to see from some low hills captured by the attack, whence it was quickly spotted and put out of action by guns of "accompaniment" again without having fired, after which the tanks advanced over the country it had been covering.

As Artillery Training says the method *is* wasteful and unfavourable to control, and if the enemy has anti-tank guns pushed well up, is likely to be unsuccessful as well. I am inclined to think that one gun cannot fulfil the functions of close support and be at the same time in readiness for immediate action against tanks as soon as they appear in the zone of our front line troops. If artillery weapons attempt to do this they will lose their capacity for close support—because they must be silent—and in many cases will not function, since they will see no targets. One gun and one tank would make a good battle with the odds on the gun, two guns and three tanks ought to be a very close thing, but when eight tanks advance together giving each other mutual support from fire, and possibly followed by their own Anti anti-tank guns, it will require a good many guns to deal with them. The number eight is mentioned, since one gathers that two sections are the minimum number which are likely to be employed in offensive operations.

The manual lays down that tanks must be distributed in depth and provision made for local reserves, so that not more than 30% of actual strengths are likely to appear in the first assault. It would appear from the above that not less than three tanks are likely to appear simultaneously in ordinary operations, and that two guns will be required to deal with them efficiently.

Artillery strengths do not permit of silent sections being spread all over the front, either in the attack or the defence, and close support howitzers are likely to be in action under cover and so near the intervening crests that they will not be able to shoot direct until the tank is very close to them.

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[1] It further says (page 167) "In the case of light guns . . . . instantaneous fuzes are not satisfactory against Tanks; delay or non delay fuzes should be used." If correct this point will require consideration (vide page 7). A fuzed shell which is efficient both as a man-killer and a tank-destructor should be manufacturable.

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An example obtained on manœuvres is to the point in this connection. The force to which I was attached had just secured a passage over a marsh and a bridge head was being formed, to secure which my howitzers were brought into action in an open position, and immediately began to fire on some hostile machine guns. An umpire rode up and pointed out that they were being fired at by machine guns and by a battery behind the crest. I replied, "Yes, but I am not really here at all : I should actually be in those trees fifty yards back, only the ground is out of bounds." He accepted that as a sound argument and rode off. Presently tanks and infantry developed a counter attack : they were engaged over open sights and the battle was stopped for the decision of the umpires. The same officer rode up again and I claimed to have put the tanks out of action. "No", he replied, "You are not actually here at all : you are behind those trees fifty yards off and would not have seen the tanks until they were on top of you. You can't have it both ways."

He was perfectly right : one *cannot* have it both ways and if this was the last word on the subject one would have to confess grave doubts as to the ability of the close support weapon to meet infantry requirements in this respect. But the writer suggests that the story is only half told : the tank is coming over the crest and the howitzer is still in action and untouched at fifty yards distance : its observer on that crest has told it where the tank is to be expected, and it is ready to fire. The tank is coming onto dead ground, and therefore must have slowed its pace to avoid pitfalls and pick its road. The howitzer is most inconspicuous, the tank most unmistakable, and the writer suggests that the odds on the howitzer knocking it out first round are about three to one. Suppose the tank does not come direct onto the gun, but passes over the crest two or three hundred yards away to a flank—so much the better for the gun! It will have more time and a equally good target. If three tanks appear together as is previously suggested, then the two battalion close support howitzers should be able to deal with them—when they appear over the crest.

But this crest will not normally be that occupied by the most advanced infantry : it will be more in the area of the support company, and the writer can see no means of emplacing close support weapons so that they can deal with tanks as soon as they appear, as well as fulfilling their normal rôle. He would suggest—for what it is worth.

(1). That the infantry should be informed that their close support weapons will deal with, and stop, advancing tanks in the "support company area" but cannot guarantee to stop them from over-running the front line.

(2). That close support weapons should not be emplaced in the open, but—ground permitting—have one hundred yards clear view all round, and be specially trained for knocking out tanks at a short "rise" 100 to 200 yards. The famous German anti-tank guns who made a holocaust of our tanks at Cambrai and elsewhere, were nearly all emplaced in this way.

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(f)). Pro-tank work.

The action of close support weapons in *support* of tanks is also worth consideration. Tanks are peculiarly vulnerable at the moment of their deployment, and up to the time when they become seriously engaged, and ordinary artillery support is difficult both to arrange and to time at short notice. Close support weapons, being on the spot, can co-operate without delay, and, under favourable conditions can put up a smoke screen which even if thin, would be welcomed by the Tank Corps, and would be of considerable service to them.

It is suggested that the tactical employment of close support howitzers in this manner is worth serious consideration, and that a certain number of smoke shell should be carried in pack battery echelons for this purpose.

(f). Anti anti-tank guns.

The efficiency of these guns chiefly depends on their mobility, they must be able to get there, and to move at least as fast as the fastest of the tanks they are supporting. Pack Artillery is not fast enough, and field artillery is not inconspicuous enough, for the purpose.

It is suggested that what is required is a high velocity gun, mounted—if possible on a fixed mounting—on some type of cross country tractor, able to go anywhere that tanks can go, and to travel a bit faster than they can. The silhouette of the whole should be low and the gun not more than three feet off the ground. It would be a species of tank and would naturally come under the control of the Tank Corps, and out of the scope of this article.

NOTE.—The writer has no knowledge of the tank manuals of other Armies, but assumes that since we have had the greatest experience on the subject, the general principles laid down by us will also be those adopted by others.

CONCLUSION.

The problems of co-ordination of infantry, tanks, and guns of accompaniment are not easy, but they are urgent. Intimate liaison between the three arms is obviously all important. We must help each other and get to know each other. It is suggested that pack artillery sections should be attached to battalions for a portion of battalion training, and that they should do field firing with them, using a shell to break up on impact similar to that described by General von Hippel as in use with the German Army (R.A. Journal, June 1922). Also that Pack Artillery Officers should do courses with the Tank Corps and vice versa. Inter-knowledge begets confidence, and confidence is the big thing in war.

The writer submits his views with great diffidence : the experience gained on the problems of close support is insufficient to base exact views upon, and the training manuals are very reticent on the subject. He has no knowledge of the laws that govern weather, food, personal

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hygiene, or the application of electricity and optics, without which the Committee on Natural Science and Colonel Garwood (R.A. Journal, December 1921) consider that there is no justification for entrusting the lives and welfare of men to his charge: he has not grown bald-headed in studying the Firmament, and is hopelessly and viciously impenitent on all these subjects,—but he has seen something of war conditions.

The problems herein considered come more under the heading of what Lord Gort (evidence to Shell Shock Committee) calls man-mastership. If the present article serves as a "cockshy" for stimulating the views and interests of more brainy individuals, it will have fulfilled its purpose.

FINIS.

NOTE.—The writer wishes to express his indebtedness to Lieut. A. G. Miller, R.G.A., for valuable suggestions offered, and for revision of proofs.

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ARTILLERY OPERATIONS, FIRST ARMY, A.E.F.

Reprint from The U.S. Field Artillery, Journal, May—June, 1922.

The Editor, *May 26, 1922.*
Field Artillery Journal.

Sir:

During the St. Mihiel and the Meuse-Argonne offensives of the First Army, American Expeditionary Forces in France, the Chief of Artillery and Commanding General of the Army Artillery, Major General Edward F. McGlachlin, Jr., U.S.A., issued a series of critical memoranda relative to the employment of artillery in the Army which had a most beneficial effect in correcting deficiencies and in developing a spirit of coöperation and mutual understanding among all of the arms concerned.

These memoranda were prepared personally by General McGlachlin and, in addition to his clear vision and wide and varied experience, were based upon personal visits and inspections of front-line troops and positions, as well as reports of other officers. In the beginning these memoranda dealt with questions affecting the Army Artillery, later the scope was amplified and the distribution included corps and division commanders as well as the artillery commanders of regiments and higher units.

Officers of various arms and services who have had an opportunity to read and study these memoranda have expressed the opinion that it was highly desirable that they be published in some form and thus be made available to all of our officers and in particular to our future artillery commanders. With this object in view the writer has attempted to extract pertinent paragraphs from the series without regard to dates of issue and to arrange same for publication by subjects. No attempt has been made to rewrite passages or to modify opinions.

When the writer consulted General McGlachlin about publishing this article the latter stated: "That much that appeared was due to suggestions of officers whom he cannot now identify so as to give them credit. He also borrowed from friendly and hostile communiques, reports, and any other sources that came into his hands. His staff should certainly receive its share of any credit for the memoranda, for they were usually, if not always, submitted to it for suggestions before issue."

However, the primary value of these memoranda, at the present time, lies in the fact that they were prepared under stress of battle conditions by the commander of the largest and most powerful artillery component ever organized or employed in battle in the history of our Army.

JOHN W. GULICK,
Lieutenant-Colonel, General Staff,
(Late Chief of Staff, Army Artillery, First Army, A.E.F.)

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LIAISON.

"The tendency in considering the subject of liaison in the abstract is to attempt to reduce it to a mathematical formula. This is not correct. Liaison is a live thing and can only be attained by live methods suited to its needs. In other words, the mission a unit is to perform determines what liaison it will be necessary for that unit to establish. One cannot lay down hard and fast rules that will govern in all cases, but a rule can be laid down for a system of liaison between artillery units and the infantry they support which forms a framework fairly permanent in its nature to which from time to time attachments or extensions must be made.

"The artillery element most closely associated with the infantry is the divisional artillery. Its mission is to clear the way for its own infantry. *Its efficiency depends largely on its exact knowledge of the plans of that infantry for the immediate future and of the location of the advance elements of that infantry at any moment*; hence, the closest liaison is essential. This is universally recognized, and quite generally steps are taken to insure such liaison. It calls for personal and telephonic liaison not only with division headquarters, but with the units of the division that are in the attacking line, even to the battalions that actually deliver the assault.

"The corps artillery, of heavier calibres and largely employed for counter-battery work, distant harassing and inter-diction—in other words, its main mission being that of securing freedom of action for the divisional artillery—requires different liaison. Personal and telephone liaison are ordinarily necessary no further down than division headquarters and the headquarters of divisional artillery.

"The army artillery, comprising in general the guns of greater range and howitzers of greater power than those in the corps, finds its principal mission in the zone beyond the normal counter-battery zone of the corps, or in the execution of set fires of destruction against works anywhere in the hostile lines for which the great power is required. Personal and telephone liaison need ordinarily only extend to the corps in whose zone of action it is operating.

"*It is a principle of all artillery that it should be able to reach with its fire half the normal zone of the next adjoining unit.* This calls for lateral liaison.

"From the above then a type liaison net would be on the following lines:

"(a) Each army artillery grouping; personal and telephone liaison with the next army artillery grouping on its right and left, and with each of the corps in whose zone of action it is operating or may operate.

"(b) Each corps artillery; telephone and personal liaison with the corps artillery on its right and left, with the divisional artillery of its own corps, and with the division headquarters when the division P. C. is not at the same place.

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"(c) Each divisional artillery; personal and telephone liaison with the divisional artilleries on its right and left, and with infantry brigades.

"This liaison net will have to be extended in various ways for every operation. Usually it will not be possible to foresee by more than a day or two, or possibly a few hours, just what extension will be required, but the means should be at hand to make any likely extension. *This demands preparation in advance, a fact generally not recognized, or, if recognized, not acted upon.*

"Our text-books on the subject of liaison are rather vague. The word itself is in constant use, but one may suspect more often than not by way of camouflage. Too often at the eleventh hour an officer is snatched from his normal duties and, with wholly inadequate instructions and with no previous training to help him, rushed to some other unit to which he is a stranger and expected to establish and maintain intelligent coöperation. The wonder is not that the results are unsatisfactory, but that good results are ever obtained. Instead of being a live, energetic, hard-working person fully informed at every moment of the powers, limitations, locations, missions and tactical operations of his own command and of that to which he is accredited, the liaison officer is more often than not a mere hanger-on who occasionally is asked to transfer a message to his own command, which anybody else could have done as well. *Liaison is so important that the personnel, therefore, both commissioned and enlisted, should be carefully selected, should be permanent, and should be sufficiently numerous to meet all possible or probable needs of the unit and still leave an ample reserve on hand for the replacement of casualties.*" (Memo. October 31, 1918.)

ARTILLERY SUPPORT.

"Frequent reference has been made in this series of memoranda to the necessity for close liaison between infantry and artillery, particularly divisional artillery and to the advantages of having the artillery well forward, that is, close to the infantry advance, for its effective support. The situation about November first and since seems to have improved in these respects. But from my own observation and from interviews, conversations and letters, I feel sure that the artillery is not yet fighting to the best advantage of the infantry. Leaving aside any discussion of accompanying guns, of roving guns or of infantry batteries, the bulk of the artillery is not yet fighting close enough to the infantry line.

"From a technical point of view forward positions of the artillery result in better observation; shorter lines between observers and guns; greater accuracy of fire, either shell or shrapnel; much greater effect of shrapnel; reduction of the number of changes of position; deeper zone of effect; increased opportunities for enfilade fire; widening of the zone of fire; much easier and more perfect liaison with the infantry; good moral effect upon the infantry; good moral effect upon the artillery itself. Some disadvantages may be loss of defilade; unfavourable angles

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of fall; longer routes of ammunition supply; longer lines of information from the rear. With the guns well up, however, the lines of information to the rear are not very important. *It is the liaison between the infantry and its supporting artillery which is important, not the liaison between the artillery and the division commander.*

"Before the war the French spoke of an average fighting range of the 75-mm. gun as 2200 metres and we, of ordinary ranges of our 3-inch gun as 2400 yards. I think we would do well to go back to this conception, to cast off the effects of our study of trench warfare, to realize that henceforth the war is to be one of movement even though that movement is sluggish, and to develop our young officers along the lines so long taught and on the principles clearly presented in the field artillery drill regulations of 1916. We have permitted ourselves to be obsessed by the idea of stabilized warfare and are now trying to apply its highly technical and scientific methods to a situation which requires the work of an artist. Brigade commanders with considerable staffs are remaining in dugouts and giving directions from the map based on scarce and late information received over imperfect lines. Subordinates are painfully scaling distances from the map and applying corrections by mathematical computations. *Much better results, many more dead Germans, killed horses and destroyed vehicles would be found if a genuine, energetic effort were made by all concerned to get direct observation and personal knowledge.*

"That the artillery is obtaining very great and important effects upon the enemy cannot be denied. I think we are all proud of it, but it is obtaining these effects at an enormous expenditure of ammunition and of consequent effort, fatigue of men, wastage of horseflesh and breaking down of motor trucks, congestion of traffic and wear on roads. So, although I see a great improvement, I believe that the artillery must be pushed closer to the front, that terrestrial observing posts must be manned and kept manned even during bad weather in order to take advantage of every fleeting favourable opportunity to observe, that commanders of all ranks must be closer to their units and that artillery officers and selected soldiers must more intimately accompany the infantry in order that information useful to and understood by the artillery may be sent back. I think that divisional commanders should insist on this.

"Ordinarily I believe a field artillery brigade commander should have his P.C. alongside the divisional commander, but I do not believe that the artillery commander should remain constantly at that P.C. any more than I believe that the divisional commander should be chained to one spot. Not so much, because the useful information to artillery units in mobile warfare should come, if the artillery fighting spirit and sense of sacrifice are sufficiently high, not from the divisional commander's headquarters, but from the infantry lines themselves. It seems probable that in the highly organized warfare of to-day advances must be by bounds—a period of mobility, a period of stability, and so on. While the lines are stable a set programme for the next

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attack must be worked out, with its involved time tables, computations, arrangements for displacement, establishment of dumps, etc., etc. During this time the personal relations between the brigade and divisional commanders should be most intimate. From the launching of the attack to the next stabilization the greatest endeavours of the brigade commander should be to maintain contact with infantry brigade and even regimental commanders, personally and through his staff. During this time one or two members of his staff can usually handle the information received from the divisional P.C.

"Although criticism is made above it must be said that many considerations extenuate the conditions. On the part of the artillery it should be said that—

"(a) There are more regiments now than there were officers of a year's service eighteen months ago.

"(b) The divisions were not trained in methods of open warfare as was required by advice from A.E.F. or orders at home.

"(c) The numerous officers and soldiers sent to the United States to help train new units were seriously tainted by their experiences of three years in the trenches. Many of them knew no other kind of warfare.

"(d) Popular reading and popular lectures on the war were about trench warfare only. The great body of new officers came into the service knowing almost nothing of the military art but fully impressed with the trench idea.

"(e) The trials and struggles of the Allies placed many of the instructors that they sent us somewhat in the position of heroes and their opinions were given too much weight.

"(f) Training in artillery firing has been injuriously affected by the exact methods appropriate to fixed defences. Art has been forgotten.

"(g) The infantry often fails and sometimes refuses to inform the artillery. It cannot expect teamwork unless it will be a party to it. It has, for example, declined the use of its lines of information, failed to protect guns far forward, hampered movement. Divisions receiving new truckage have neglected artillery units attached to them.

"*I appeal to artillerymen and infantrymen alike to get together not only in conferences, of course, but at the mess, on leave, in Paris, informally anywhere, and talk things over as comrades not as advocates. The faults are not on one side only.*

"Following are extracts from a letter from a valued artillery correspondent:

> "' * * * we were with the infantry most of the time, as it is at this point that one can best see whether or not the artillery support is effective. It was not. I could recite many instances in support of this statement. For example, we encountered in our wandering an infantry company commander whose company was then held up before the village of * * *. According to his statements, he was using all of the fire power at his disposal to overcome a very stiff machine-gun resistance, but seemed doubtful as to whether he

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could make a go of it. We asked him why he did not call for artillery support. He replied that he was trying to get artillery support but could not get communication, although he thought it might come later. We passed through Artillery Brigade Headquarters several hours later and General * * * then mentioned that the infantry was calling for artillery fire near***. At seven o'clock of this same morning we saw General * * * , commanding an infantry brigade, out with his first line which had been held up. Replying to our questions, he stated that he was held up and needed artillery support but could not get communication. All during the time we were in this vicinity we could see everywhere opportunities for accurately adjusted artillery fire on easy targets. Such fire could have been delivered, even without liaison with the infantry, as the position of our own infantry was quite evident. Such fire could have been made even more effective with infantry liaison which could have been obtained without difficulty.

" 'The conditions observed here were no different, as a general proposition, from those that I have observed everywhere. * * * the lack of close support of the infantry by the artillery, * * * many reports from actual eye-witnesses of the operations from the position of the infantry. I feel certain that if our artillery officers, particularly the brigade, regimental and battalion commanders, would more frequently go to the infantry during these operations and actually see conditions as they exist their ideas in many matters would immediately change. Too many opinions are expressed and methods used based on experience acquired at the end of a telephone line some distance in rear of the scene of action. For example, on this particular day, when we returned to division headquarters, all conversation which we had indicated that everything was going nicely. It is possible that this was camouflage, but I am more inclined to believe that it was due to a lack of knowledge on the part of the commanders in rear of actual conditions on the firing line * * * .

" 'One infantry brigade commander had the situation quite well sized up, I thought. He said that our artillery was fine in carrying out an operation which could all be planned and laid out beforehand, but that when it was required to act in situations which had not been foreseen and planned beforehand, it fell down. The difficulties that we are encountering to-day are due simply to the fact that when the infantry encounters, unexpectedly, resistance which requires artillery fire, such fire cannot be obtained promptly and accurately. To meet this condition artillery observers, and above all artillery commanders, must be forward where they can see, and command as a result of seeing. Forward observation is not, however, in itself enough. The guns must be so placed, with respect to observation, that long lines of communication between observers and batteries will not be necessary. This means to bring the guns forward. The only limitation on this is

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to secure sufficient protection for the guns to prevent annihilation * * * .

" 'An officer who was with the * * * Division during these same operations was particularly enthusiastic about the work of Colonel * * * regiment of 75's. He stated that these guns were constantly up to about 1000 or 1500 metres and that the infantry could call for fire and get it in five minutes or so. This is a condition which I myself have never found in my quite numerous visits to the front during open operations. Needless to say, the infantry were delighted in this case and made splendid progress. I hear that * * * expressed themselves quite forcibly very recently against this idea of moving artillery way up front, stating that it only got shot up and out of hand. My only answer to such ideas is that their artillery is not trained to fight in open warfare (and this type requires more skill than firing a barrage), and that their artillery gets out of hand because they are themselves too far back to keep it in hand.' " (Memo. No. 12, November 6, 1918.)

ARTILLERY POSITIONS.

" 1. Referring to paragraph *i* of memorandum from these headquarters of 11 October, divisional artillery is still altogether too far behind the infantry lines. While a certain disposition in depth is advisable for purposes of defense and is sometimes rendered necessary by the nature of the terrain, not only in our own lines, but beyond our own lines as affecting positions of hostile targets, the intention of continuing an offensive imposes the duty on the artillery of being well forward in support of the infantry. Well-advanced positions have the following advantages :

"*a*. They afford a moral support to the infantry.
"*b*. The guns can fire effectively over a deeper zone.
"*c*. The guns can fire effectively over a broader front.
"*d*. The effectiveness of fire in preparation for the attack is much increased.
"*e*. The barrages are more effective and can be carried over greater distances.
"*f*. Lines of information from forward observers are shorter.
"*g*. Runner service is simplified and routes are shortened.
"*h*. Fewer changes of position are necessary.
"*i*. There are more opportunities for good observation from the vicinity of the guns.

"*We must shake ourselves out of the hypnotism of a defensive or stabilized front. In the warfare of slow movement which we have been experiencing and through which we are going now, instances of 75-mm. guns remaining at six, seven and eight kilometres behind the infantry lines constitute a reproach to artillery commanders.*

"It should not be unusual to find light batteries less than from 1800 to 2400 metres in rear of the front lines.

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"2. On the other hand, the presence of guns much nearer than the above distances to the front lines has the following disadvantages:

"*a*. Serious losses among animals, which cannot be replaced; resulting immobilization.

"*b*. Greatly increased difficulty of ammunition supply.

"*c*. Impossibility of firing upon areas in the immediate foreground of the infantry.

"3. There seems to be an idea among officers not of the artillery that what they call 'direct fire' is of some special effect. They usually mean fire by *direct laying*. Except for 'sniping' with single guns, as against machine-gun nests, tanks, moving objects and some other special targets, indirect laying will give the best effect—the most accurate, the best distributed, the most evenly controlled.

"4. Guns in the infantry line with, usually, a small amount of ammunition to fire upon special targets should doubtless be often used. They should be emplaced after special reconnaissance, ordinarily by hand, and at night with precautions to prevent noise and discovery. Often they can be worked forward through woods in the daytime.

"5. It should be remembered that artillery acts by fire alone; that accompanying fire is needed, not physical accompaniment; that no fire can be delivered by guns in movement; that every occupation of position may reduce the period of fire.

"6. Examples from recent operations of violation of every principle stated above could be given. The principles appear, however, in our drill regulations and field service regulations.

"7. The fundamental errors seem to be—

"*a*. A very general outlook upon all situations in the light of the stabilized warfare of the past few years.

"*b*. Too great consideration of the defensive.

"*c*. Very frequent orders by the uninformed to apply specified means instead of to accomplish a definite mission.

"Three major considerations govern the choice of battery positions; suitability for firing mission, accessibility, concealment. The first two speak for themselves, but the third is apparently often misunderstood by battalion and battery commanders.

"There is nothing sacred about concealment in itself. It is simply a means to the end of protecting a battery from enemy fire. If it doesn't do this, it is quite immaterial that the position may be theoretically invisible. The enemy doesn't have to see the battery, all he needs is to know where it is.

"Accordingly little is to be gained by way of concealment if the position chosen is so located as to be in a natural zone of enemy fire. Certain spots are foredoomed to be fired on, whether they are known to contain batteries or not. Perhaps the most conspicuous examples of this are the borders of wood facing the enemy and important crossroads. These will be shelled simply because they are what they are, for exactly the same reasons that we shell similar portions of the enemy's territory. Hence, a position located in either of these areas,

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no matter how adroitly camouflaged and sedulously safeguarded, will receive a certain amount of enemy fire and a particularly close enemy inspection. And, upon the slightest suspicion, this merely general treatment will grow into controlled fire of the greatest severity.

"There are, of course, times when the tactical situation demands a dangerous position, but there are also very many instances where naturally dangerous locations—especially along the borders of woods—are chosen just because they offer at the same time both ready-made concealment and easy fields of fire. Such shortsightedness is highly dangerous. *It is a safe rule in the selection of positions to put oneself in the enemy's P.C. If you were there, would you be apt to fire on or near the contemplated position? If you would be, keep out of it. His mind works like yours.*" (Memos. October 14 and 27, 1918.)

OBSERVATION.

"It is of the utmost importance that observers be sent forward and that suitable observing points be taken advantage of in order that our fire may be more accurate. This is particularly necessary in this climate and at this season when neither aeroplane nor balloon observation can often be depended upon. Observation from the ground is the most effective of all and can surely be obtained much oftener than it has been. Reconnaissances of observing stations should be going on all the time. *Terrestrial observation, the best of all, or aerial observation will result in an enormous saving of ammunition or in an enormously increased effect for the same amount of ammunition. The influence of good observation upon effect reacts upon the question of ammunition supply and that upon the condition of animals and their supply.*

"In the A.I.S. reports of army artillery groupings will be incorporated daily—a complete list of calls upon aviation units for adjustment; the hour; the target; the firing unit; the response; the reason given by aviation unit if the mission is not attempted, or if it is delayed; the opinion of artillery commanders of the reason given; the result if the mission is undertaken; a general statement of the efficiency of aerial observation for the day. At the completion of an operation army artillery unit commanders will submit recommendations tending to improvement of results obtained by aerial observation.

"Prohibition of traffic may often be made very effective with comparatively few rounds by damage to routes at sensitive points followed by occasional bursts to prevent repaid and by occasional rounds on probable routes around the points of damage.

"With accurate preliminary calculation of firing data corrected up to the minute for meteorological conditions, it is believed that the following should give excellent results:

"*a.* Use all the guns of the battery.

"*b.* Fire twelve rounds in volleys with constant data as rapidly as is consistent with orders and conditions.

"*c.* Let the artillery observer report the centre of burst of the group of rounds.

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"*d.* Make a transport of fire.

"This should—

"*a.* Save time.

"*b.* Permit shorter flights.

"*c.* Make powerful concentrations easy and quick.

"Fire whose adjustment is observed is from sixty-five to eighty times as effective as fire from calculated data only." (Memo. October 14 and September 25, 1918.)

COMMON ARTILLERY MISTAKES.

"Many criticisms of the American use of artillery have been made. The following have been gathered from numerous sources and are stated as briefly as possible. The purpose of publishing them is that officers may ask themselves the question as to whether they have fallen into the mistakes mentioned and may take the proper steps to correct them.

"1. Orders requiring barrages were not received in time to permit the numerous calculations necessary."

It is the duty of artillery officers to inform their superiors of such cases.

"2. Smoke shell are not used sufficiently in barrages."

Their use will diminish the effectiveness of hostile machine guns.

"3. Barrages are too often fired from the map."

Allowance for safety prevents the barrages being placed close enough to protect the line. Serious efforts should be made to adjust barrages by observation beforehand.

"4. Barrages have been started too far in advance of the infantry, which has not been able to overtake them.

"5. On the other hand, when the position of the nearest enemy elements was definitely known barrages have been placed close to our own lines when they might well have been held for the necessary time on a line slightly short of the enemy positions.

"6. Firing has been very largely by map."

Such fire cannot have the maximum effect. Observation of fire must be constantly sought.

"7. Barrages have been used for destructive fire at a tremendous waste of ammunition."

Observation of fire on definite objectives which may impede the infantry advance would obviate the necessity for this.

"8. Shrapnel has been too little used."

Adjustment of height of burst is impossible without observation. Adjustment at normal height of burst is difficult under any circumstances. The inexperienced officer will accomplish effective fire with shrapnel most easily by obtaining bursts half on impact and half in air. The dispersion of shrapnel bullets is particularly effective in the open and in light brush against personnel not definitely located.

"9. Coöperation with, and support of, the infantry has been defective through lack of liaison."

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Liaison with the infantry being supported must be direct, positive and multiple. It must be advanced as far as is necessary to determine the situation and needs of the foremost infantry at any time. If the artillery commander can himself be with the infantry commander having knowledge of the situation while retaining complete control of his own command, results will be most satisfactory. If he cannot be in personal touch with the infantry commander he must have visual or wire communication or both.

"10. The use of artillery scouts for protection and observation has been neglected.

"11. Opportunities have been missed for the effective use of single light guns in immediate support of the infantry."

Extremely favourable results have been obtained by guns used as above. Firing usually at short range the cone of dispersion of shrapnel is very deep, and, direct laying being used, very accurate. They have wiped out whole nests of machine guns. Their close support is very encouraging to the infantry. The services of forward pieces is sought by bold artillery soldiers. It develops initiative, cunning and decision.

On the other hand, the indiscriminate use of such guns, the devotion of too many of them to the purpose, weakens the power of the artillery unit and is undesirable. Their use is most applicable in broken and wooded country.

"12. Officers and operators are too loquacious in their use of the telephone."

Messages by telephone should be as carefully thought out as though the telegraph were to be used. They should follow the form as far as possible of the five-paragraph field order.

"13. Officers interested in orders are not often enough assembled to hear them."

When orders are issued orally to several persons separately they are usually given in varying language and variously interpreted. Whenever it is possible it is most desirable that the recipients of such orders should be assembled and that in well-chosen words the order should be delivered in the five-paragraph form. Discussion afterward will lead to a uniform understanding.

"14. Sufficient reconnaissance to determine a practicable scheme of advance has often not been made."

The availability, condition, location and length of routes should be thoroughly known and carefully weighed, in order to reconcile two conflicting requirements.

First, the necessity of moving forward in order to bring desired objectives within range.

Second, the necessity of being emplaced in order to fire—that is, of not starting a displacement which cannot be carried through in the proper time.

"15. The forward displacement of artillery has not been prompt.

"16. It has been attempted to move more artillery at one time than traffic conditions would permit.

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"17. Guns intended to accompany the infantry have not been placed close to the latter before the commencement of the attack.

"18. Means—such as lumber—have not been provided for overcoming obstacles likely to be met by accompanying guns.

"19. The initial positions of batteries have not been far enough forward.

"20. Combat trains have not been provided with ammunition in preparation for an advance."

During movement one cannot depend upon ammunition dumps. Ammunition must go forward with the guns and the supply must be kept up according to the methods of open warfare.

"21. Upon moving forward a good balance between light and heavy artillery of the divisional brigades has not always been maintained."

The integrity of regiments is not important in this case.

"22. *Divisional artillery has undertaken missions suitable for army corps and army artillery, both of which were present in sufficient amount.*"

In the present operation the assignment of artillery has been based upon the following general rules:

The divisional artillery is for the purpose of preparation and counter-preparation in support and protection of the divisional infantry.

The army corps artillery for counter-battery work.

The army artillery for harassing and prohibitive fire and distant counter-battery.

The powers and limitations of the guns have been taken into consideration. Objectives discovered by divisional artillery not consistent with its tasks or outside its proper zone or beyond its power, should be reported with the greatest promptness to the corps chief of artillery or to the commander of one of his groupings or directly to the commander of an army artillery grouping. Ordinarily the channel should be from the unit discovering the objective to the artillery brigade commander to the corps artillery commander, thence to the army artillery grouping or to the army artillery commander, but although this method is sure it is also likely to be slow and any favourable shortcut should be resorted to. (Memo. October 27, 1918.)

ACCOMPANYING PIECES.

"In Vol. III, Drill Regulations for 75 French Gun, September, 1918, appears the following:

" '976. Plans for the employment of light artillery may include pieces for the direct accompaniment of infantry battalions and regiments in attack, to reduce strong points and machine-gun nests. Such pieces fire at short range and usually with direct laying.

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" 'Platoon commanders and chiefs of section must be practiced in the conduct of fire under these condtiions, as well as in the selection and occupation of positions for immediate action. Exceptional provision must be made for the supply of ammunition.'

"This use of guns is liable to complete neglect for various reasons.

"*Some artillerymen are too narrow-minded and too resentful of what they call a violation of the principle of unity of command to be willing to detach pieces for the purpose.*

"Some infantrymen are too ignorant of the value of such pieces.

"Some artillerymen are too ignorant of the problems which the infantry have to solve to realize the great assistance that can often be thus given.

"Some infantrymen assume command of such guns to the smallest details, ordering them to specified places and directing the method of their use.

"There have been repeated instances on the present front of their effective use, of their abuse and of their neglect.

"*It should be the pride of the artilleryman to devote his pieces by any effective method to the support of the infantry. That is his whole duty. On the other hand, the infantryman should take advantage of the artilleryman's technical training by assigning him a mission and permitting him to accomplish it. Lack of consideration on either side is fatal to teamwork.*

"Wooded, close and broken country and the warfare of slow movement offer many opportunities for such work, but there is no normal distribution of the guns. Unless a study of the map or, best of all, actual reconnaissance and perfect knowledge of the situation, make it highly probable that single guns will be needed, it is better not to detach them because of the resultant loss of power of the unit to which they belong. Such studies and reconnaissances should preferably be made by infantrymen and artillerymen working together.

"A frequent very valuable use of these guns will be found in local attacks on a semi-stabilized front and in bush-whacking through woods. Often the infantryman will have to help move the guns and carry ammunition.

"A study of the use of captured guns and ammunition in this fashion may be well repaid.

"The mere presence of accompanying pieces frequently has a moral effect upon the infantry quite disproportionate to the services they actually render. Infantry which has been ably supported by artillery soon gets a feeling of confidence in the mere proximity of that arm, which has a direct reaction upon its own performances. Such a feeling is worth a good deal. Conversely, however, lack of artillery support, even when this is not tactically essential, has a depressing effect. When the front line soldier hears enemy shells falling with no reply from his side he wonders where the artillery is, whether it is up, or if it is out of action. Then he wonders what will

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happen to him if the enemy attack and he has to face it alone. Good infantry commanders, whose troops are under fire, frequently call for return fire just for the heartening effect of hearing one's own shells on their way.

"The first duty of an advance piece, therefore, is to be an advance piece—not to have some good reason why it could not get up. Its mission is to accompany the infantry and help them in their emergencies, not to save horses. Therefore, mobility should be assured and doubly assured. Take an extra caisson, it can be left when empty and its horses keep on. Take an entire extra hitch—horses, drivers, harness—they may be needed in a hurry, and if not the drivers can act as linemen or spare cannoneers. Have all the individual mounted men carry draft harness. It won't hurt their mobility and it may move the piece. There will be no chance to send back for anything.

"The second duty is to make the gun 100 per cent. efficient. That means speed in occupying a position and in serving the piece, and accuracy in everything. When the caissons and limbers are empty the gun is dead. The infantry expect magic results from point-blank or short-range fire and magic results can be had if the piece is given a chance. Even a machine gun lacks the sobering effect of repeated shell bursts in the midst of the enemy. *The service of the forward piece should be a post of supreme honour, should be designated in advance, and if possible its crew should have a chance to practice as an entire unit.*

"The following is suggested as the equipment of a forward piece. It can be improved upon, but is believed to contain all essentials:

1 Gun, 75 mm.
2 Caissons (50 per cent. of H.E. reduced and No. 20 Gas in each).
3 Limbers (Shrapnel in 2, H.E. normal in one).
1 Ration cart (with can of water).
24 Horses, draft (4 six-horse hitches) with harness.
2 Horses with Q.M. harness (ration cart).
10 Horses, riding, with draft harness.
3 Field telephones.
1 Blinker.
3 Sets flags.
5 Kms. light piano wire.
3 Picks.
5 Shovels.
5 Wire cutters.
5 Axes.
2 Days' grain.
3 Days' rations.

"The personnel may include—

1 Officer.
1 Sergeant.

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3 Corporals (1 telephone).
6 Cannoneers.
13 Drivers.
3 Telephone detail.
2 Scouts (and signallers).

"These men will assume a hazardous duty. They should be selected upon such a basis." (Memo. October 29, 1918.)

ROVING PIECES.

"The wandering piece or roving gun is not an infantry gun or an accompanying piece. It is used to—

"*a*. Deceive the enemy.

"*b*. Accomplish special missions.

"It deceives the enemy by firing from a temporary position, from a position other than that of the unit to which it belongs. It may fire only one series from such position or it may return to it from time to time with the purpose of leading the enemy to believe that it is permanently occupied. It remains usually but a very short time, thus avoiding counter-battery. It hits and gets away. In stabilized or semi-stabilized warfare its skillful use may establish a conviction in the hostile mind that much more artillery opposes him than is really the case. This may lead to a great waste of ammunition by the enemy in preparation by counter-battery for an offensive or in counter preparation by counter-battery on the occasion of our attack.

"It accomplishes a special mission in such ways as by moving forward to come within range of a distant objective as, for example, from a defensive position; or by moving backward to obtain a more favourable angle of fall or a suitable least range; or laterally to a place convenient for enfilade fire or for covering a neighbouring or different front.

"Great trickiness, ingenuity and skill may be devoted to its use. It is not like the accompanying gun, but depends upon speed and quickness and secrecy and shrewdness. It should occupy likely positions, usually near a road, even a poor road. But it should not fire from a place where counter-battery is likely to injure other friendly troops either at the time of firing or later. Its proper application will afford many opportunities to train personnel in reconnaissance and map reading, study of terrain, observation of fire, tactical judgment, command, care of material and animals, use of cover and preparation and conduct of fire. It will develop courage, self-reliance and decision.

"Recently the enemy active positions reported in a restricted area in one day were 29. There was no known tactical reason for this sudden increase from almost nothing of the previous days, neither is there reason to believe that we discovered all of his firing positions. But there is reason for believing that he had not 29 batteries at his disposition in that area and study of the map indicates that some of the positions were not good for the defensive or in accordance with his principles while some would probably not accommodate a battery.

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Good weather and dry roads may have had something to do with it. It would be very pleasant for him if we were to devote a great number of rounds to beat up vacant lots.

"*The roving gun is a comparatively new game at which we must be skilful in deceiving the enemy and causing him losses, and in discovering his deceit. But when he plays it the only punishment to apply is by hitting him in the act.* To do this we must have good terrestrial observation to bring down fire at once, because his wandering gun is a fugitive target. It is worth severe concentrations but only on the instant." (Memo. October 31, 1918.)

ARMY ARTILLERY.

"1. There are—

"Divisional Artillery.
"Army Corps Artillery.
"Army Artillery—
"Tractor-drawn, nearly all 155-mm. G.P.F.
"Railway artillery.

"2. It is increasingly apparent that many officers are not aware of this classification or of the long range and great power of the army artillery.

"3. The 155-mm. G.P.F. gun has an extreme range of almost exactly 10 miles (16 km.) and a traversing arc of 60 degrees (one-sixth of a circle). These are extraordinary characteristics. By virtue of them a single grouping has in one day supported the infantry on the fronts of three army corps. On the other hand, three groupings, widely separated in three corps areas, have coöperated to fire at one time in front of the infantry of the centre corps.

"4. The gun fires a powerful shell with fuses appropriate to various conditions and produces very severe effects.

"5. The gun is made for long-range work. It is accurate for range up to about 12 km., but has considerable and increasing dispersion in range as the latter increases. It is very accurate in direction. So far as its shooting qualities go, it is very suitable for counter-battery up to about 12 km. Beyond this it is the appropriate gun for harassing, interdiction, prohibitive fire, for destruction of large targets like towns, camps, etc., and for enfilading railroads, trenches, ravines, etc. It is not suitable for destruction of dugouts or trench systems.

"6. Unfortunately, the gun's life is only about 3000 rounds, and it cannot be fired rapidly without decreasing this life. The maximum rate of fire permitted is one round in one and a half minutes. Besides, it is expensive and the facilities for replacement and retubing are not sufficient. The normal rate of fire is one round in three minutes. There are several other guns and howitzers suitable for counter-battery at ranges less than 12 km.

"7. In order to save its life and devote it to its best purposes (for which no other gun is at hand) the 155-mm. G.P.F. has since

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September 25th been kept at the disposal of the First Army. But not without exception, for a whole brigade of 72 guns was turned over to an army corps for one operation, and much counter-battery has been undertaken at the request of various corps from time to time.

"8. The gun has other limitations. Its track is very wide—8 feet. It is very mobile, considering its qualities, but it is slow. Its ammunition is heavy and the supply is difficult. It takes several hours to emplace and some time to prepare for travelling. It often stirs a foolish impatience and resentment among military police, traffic regulators and staffs very unworthy of them. The gun has been, and will continue to be, a savior of doughboy lives, and I can vouch for it that those who command and serve it are devoted to the support of the infantry as their first duty. Prisoner's testimony is plentiful as to the great effect of artillery in their back areas. The 155-mm. G.P.F. is the gun that they testify for in the main.

"9. A good many examples could be quoted from the army artillery diary to show failures to use this powerful weapon. For example, fire of army artillery south of parallel 288 was stopped either September 27th or 28th. Yet this parallel was not reached until October 26th and the jumping off line of November 1st was approximately on it. On a certain part of the front, fire was stopped south of parallel 301 on November 2nd, but no infantry came near that line even on November 3rd. There seems to be either an over-confidence as to advances to be made not borne out by experience or an unwarranted fear that losses will be suffered from friendly artillery fire. The latter is often claimed by inexperienced troops, rarely proven and often shown to have been utterly impossible. When it does happen it is not because the advance runs into it, but usually through defective ammunition. If shell bursts are in front of the infantry the latter will not run into them. If large areas are to be taken it is ordinarily not worth while to keep artillery fire out of them for fear of injuring a few lost, small patrols.

"10. In the attack of November 1st one corps asked for preparatory fire by 155-mm. G.P.F.'s on objectives about a kilometre in front of its line. The fire was delivered accurately and very effectively by a distant Army Artillery Grouping. Moreover, fire from G.P.F.'s preceded this corps' attack during a whole day, not as a barrage, but according to a predetermined programme. See the Boche communique as to the character of the artillery fire and as to the result—a piercing of the Hun artillery position. It is not thought for a moment that the 155-mm. G.P.F. should be credited with more than its fair part in the accomplishment. Divisional and corps artillery certainly did theirs also.

"11. *The Army Artillery P.C. is always open. The army artillery grouping commanders maintain liaison with corps chiefs of artillery. They are ordered to coöperate freely, undertaking any mission that they can accomplish without interference with a mission assigned by higher authority. They are even authorized to set aside an assigned mission on their own responsibility. If they cannot do*

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what is asked they may refer the matter up or to another grouping. They are willing and anxious to do these things. They know their business, the powers and limitations of their guns. They attempt through officers and runners to keep in touch with the situation in divisions. At least one such army artillery liaison officer went "over the top" with the infantry on November 1st.

"12. The field of application of long-range guns is broad and deep. Their dispositions are the same. Liaison, either metallic or personal, is therefore difficult, especially laterally. The telephone usually works from front to rear and rear to front. For fugitive targets the army artillery cannot usually be depended upon unless fire is called for by aerial observers. Usually, however, timely fire can be brought upon stationary targets, such as concentrations, works, sensitive points, etc., by use of the telephone. Fire in close support of an advance cannot be made safe except by prearranged schedule, easy to draw up but sometimes requiring several hours' work.

"13. *The army artillery cannot force its amicable intentions upon any corps but it offers its services, describes above its powers and limitations and bespeaks the good will of G-1's and the Military Police in order that its powerful assistance may be devoted to the support of the infantry.*" (Memo. November 4, 1918.)

* * * * * *

SECRECY.

"Precautions as to secrecy are vital. Many units have been careless in respect of this, and some have ignored even the simplest measures. One commissioned officer has actually disobeyed orders. For his credit and for his personal interest every commander of army artillery units is directed to pay minute attention to the subject. It covers every military activity not only before but after the opening of fire and involves the movements and the conversation of individuals. Its importance extends to future operations. We should be so careful that orders to make a show of activity should be necessary rather than orders to be secret. There will be no toleration of neglect or disobedience.

"*Secrecy carries with it many difficulties. Often these must be overcome by hard and exhausting work. Often they may be surmounted by ingenuity, skill and thoughtfulness. And in any event secrecy will be rewarded by the increased killing of the enemy and by saving the lives of our own men.*"

"In the matter of maintaining secrecy, the following note appears in a recent French Army bulletin:

" 'The statements of natives of Alsace-Lorraine taken prisoner prove that the Germans were made aware of our preparations for the attack of the 19th instant by overhearing indiscreet conversation through their listening posts. The talk overheard was mainly calls and conversation in clear by artillerymen.

" 'It should be pointed out that indiscreet remarks can be easily

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overheard, especially in regions where the enemy before retiring was able to leave devices facilitating listening-in. Abandoned telephone lines, the wires of which could be buried, can help the enemy in this.' " (Memos. September 23 and October 27, 1918.)

ORDERS.

"In many, if not most, cases firing orders are sent to batteries with the bare statement: 'Fire so many rounds on such coördinates at such and such times.' Nothing is said as to what the target is, or as to the purpose the fire is to serve. This makes fire at the battery a matter of absolute routine, with no more stimulus to careful work than would be given by target practice on a range. Officers and men alike become automata, and the accurate, snappy service of the piece inevitably suffers.

"Anything that increases the interest of the soldier increases his efficiency and his value. His greatest interest is exactly the same as that of every officer. 'What is being done to injure the enemy, and what is its success.' If men are told to: 'Fire 10 rounds on Point 32.46,' they will do just that. If they are told: 'There is a wagon train of 14 wagons just approaching Point 32.46, fire 10 rounds on that point,' they will put a maximum of careful effort into every shot. If the shoot is observed to be successful, and a report of its result is sent to the battery, the men will talk of it for days, and half of them will try to get it by the censor when they write home.

"Such interest is worth creating and preserving, even at the cost of a little more labour in giving orders and news. Each unit regards its immediate superior headquarters as equipped with special information and special knowledge, and every such item that comes therefrom is weighed and valued. Most of it can safely be passed down, especially information as to the effect of one's efforts upon the enemy. *Let the men know how the war goes and what they are doing to win it. Frankly to state the facts is the best way to defeat rumour and to prevent false hopes or false fears.*" (Memo. October 22, 1918.)

ARTILLERY EFFICIENCY.

"The Hun is skillful in the use of an inferior mass of artillery. From my knowledge of our older artillery officers of the regular army and of the character of the younger officers of reserves, militia, national army and regulars, I have a strong belief in their capacity to excel all others. They do not excel now. Study, reflection, intimate relations with the infantry, adaptability, boldness, a shaking out of the hypnotism of trench warfare, development of the self-reliance and initiative of non-commissioned officers, care and conservation of men, animals, material and ammunition—all of these must be developed. We beat the Boche, as his own evidence assures us, but it is by mass, not by art, and our waste is enormous. His methods are an excellent pattern to be studied and improved upon." (Memo. October 26, 1918.)

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A GRAPHICAL PLOTTING METHOD.

BY H. G. COURTNEY, (LATE LIEUT. R.G.A.) S.R.

IN Artillery Training (1920), Vol. II, Section 74, reference is made to the possibility of plotting by means of a graph representing the area near the target drawn on a piece of squared paper, but its employment is limited to cross observation and defects noted are "that it is only useful for one target, it takes some time to make, and as the rays are drawn parallel, the graph is only accurate for rounds close to the target."

The following notes suggest a method of drawing such a graph quickly and with a close approximation to accuracy, and applying it to single line observation. Each graph will be limited to targets within an area of about 300 yds. square, but can be used, when there is only one observer, for more than one target in that area. This method was found effective and has the advantage of being workable in the most contracted O.P. Army Book No. 152 is a convenient size for the purpose.

Taking the centre of a page as target, draw vertical and horizontal lines through this point. Vertical Line = line BT. Along the horizontal line on either side of T mark a degree scale to accord with the Battery Range, as follows. Consider the side of one square as representing the distance subtending 1° at 1,000 yds. range. By similar triangles ten squares will therefore represent distance subtending 1° at 10,000 yds. range. For any intermediate range 1° point is fixed by counting the number of squares on either side of BT equivalent to that range, reckoning each square as 1,000 yds.

At double the range mark 2°, and so on as far as the width of the paper permits.

For long ranges subdivide degrees; e.g. for a range of 13,500 yds. $4\frac{1}{2}$ squares will stand for 20′, 9 squares for 40′, of deflection from BT.

The scale adopted is such that the side of each square equals 17·45 yds., this being the distance subtending 1° at 1,000 yds. Hence on the range or elevation scale, to be marked along line BT ± Target, 6 squares may be counted as 100 yds.

This introduces an error of 4·7 per cent. (6 × 17·45 = 104·7) which, being covered by the 50 per cent, length zone of the gun, is for practical purposes negligible.

For guns ranging in degrees mark a scale of minutes of gun elevation ± T. instead of the scale of yards.

With a protractor draw line OT and through T a line at right angles to OT. Along this line mark degree points in accordance with observer's range, either with dividers or using the edge of a page removed from the notebook. Through these points draw observer's grid.

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If observer's range is so short that lines parallel with OT involve any material inaccuracy they may be correctly drawn with protractor, by reference to the line at right angles to OT, and this scarcely takes longer than drawing them parallel.

The diagram for a single observer is now completed, in all essentials, but if the country is mapped it will of course be useful to insert on it any recognizable features on the ground near target.

For ranging on the line of observation corrections may be read from the graph; factors and mental arithmetic are eliminated.

To bring round on to OT by elevation, correction is indicated by the point at which line of observation of shot cuts Battery elevation scale. Similarly, a deflection correction is given by the point at which this line cuts Battery deflection scale. If conditions are as shown on Fig. 1. The correction for an observation of 4° Rt. would be either 1° 10′ M.L., or drop about 230 yds. If L. of O. of a first round cuts Battery scales outside limits of paper, halve the observation and double correction indicated.

As soon as a clear + or – of Target from O has been obtained bracketing will commence, irrespective of whether shot has fallen on or very near OT. In this connection a road, trench, or other visible feature, may give the information needed where it would have been impossible to judge whether the shot had fallen + or – by reference only to the target itself. Where circumstances permit the principles of sector ranging and of ranging on line OT may thus be to some extent applied together, as laid down in A.T. Vol. II, p. 154. For instance, in the illustration given, the decision whether an obs. of 4° right should be followed by an elevation or deflection correction might be made to depend on whether shot had fallen + or – Road.

Bracketing corrections, equivalent to applying the "combined factor" with a proportionate amount of elevation or deflection added or deducted to allow for the distance right or left of OT at which shot has fallen, may be read as follows.

If bracketing by deflection, mark on diagram the point at which line from Battery with the whole deflection determined on intersects L. of O. of shot, and plot this point for corresponding change of elevation by reference to the elevation scale on BT. (e.g.), on Fig. 1. The correction for an observation of 1° Rt. — would be 1° – 20′ M.L. add 200 yds., or 40′ M.L. add 70 yds.

If bracketing by elevation, the deflection to correspond with the elevation bracket will be read in a similar way.

If a building or the like exists where shown and a shot is observed 3° Left, + Building – Road, it will immediately be plotted as not more than 20′ out for line, and not more than 200 or less than 100 yards shot.

Thus after round has been brought on to or near OT. by adding 150 yds., the subsequent bracketing process will be shortened by this knowledge of maximum error for line.

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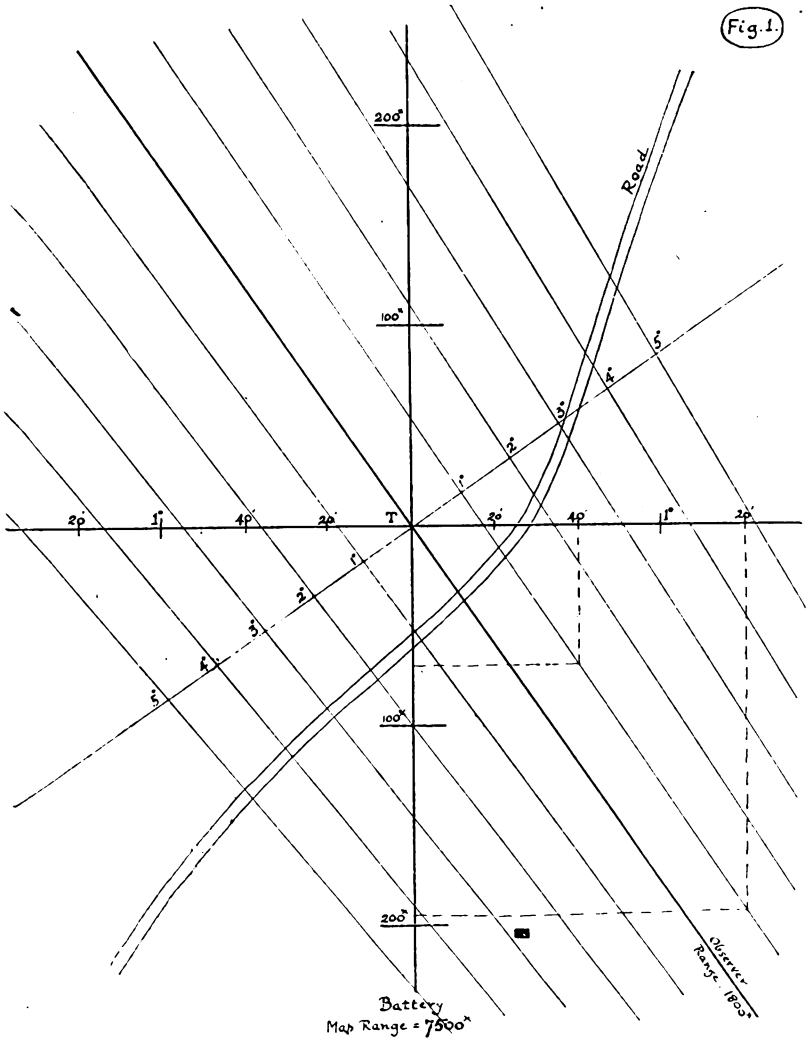

The method was found more especially useful for targets of a complicated or irregular form, such as wire and trenches. In the example shown in Fig. 2, which is an actual case, the task was to destroy the wire along line ABCD. The angle B is a convenient reference point and occupies the middle of the picture, but it is obviously best to begin shooting on the section CD in enfilade, where no ranging shots should be wasted.

After M.P.I. has been established somewhere about the points c and d, and this section finished, the rest is thereby made comparatively easy, corrected ranges to all points being now known and switches read from the graph. When the shoot is being conducted from a position in which a large scale map can conveniently be spread out

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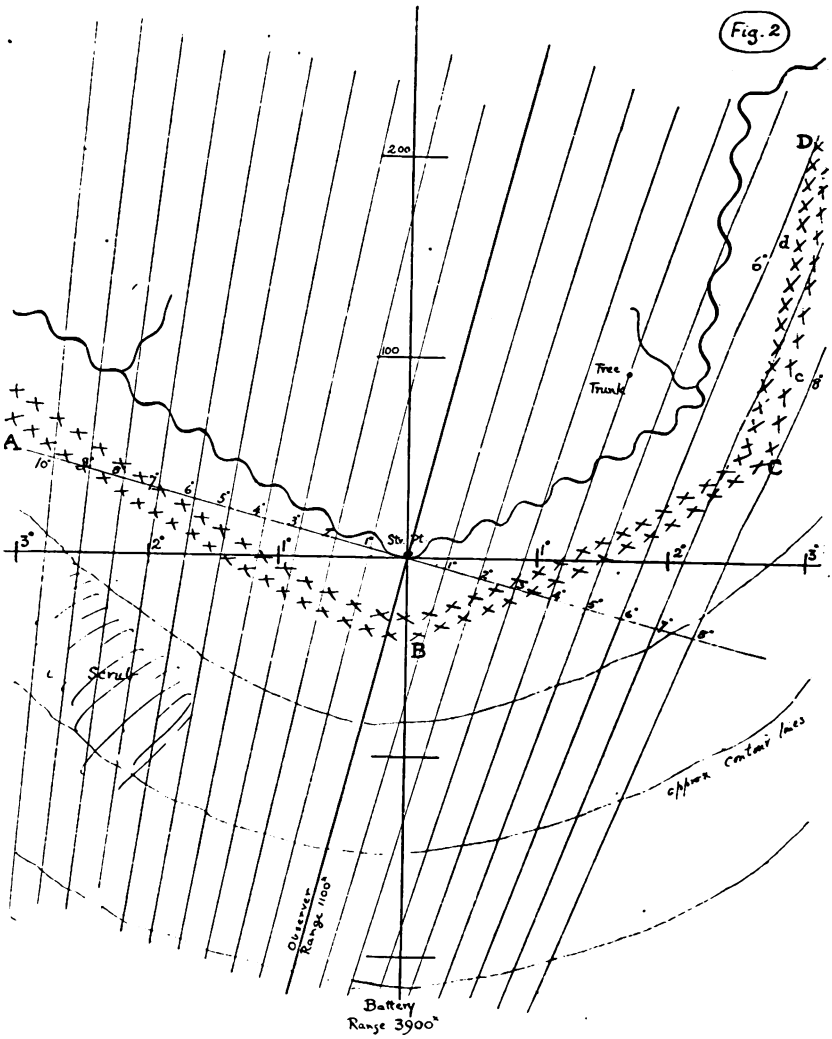

these switches, etc. may of course as well be read from the map direct, but circumstances frequently made this difficult or impossible, as when the O.P. consisted of standing room in a trench.

Moreover, from the process of copying on an enlarged scale and comparison of the observer's lines on the graph with his actual view of the ground, facts may emerge which would otherwise escape notice.

As an alternative to using a squared notebook the writer had a special protractor by which the graph was drawn on a plain sheet of paper rather more rapidly than by the method described, and with absolute precision. This instrument was constructed to fulfil most of the purposes for which the ordinary protractor is used, to avoid having to carry two.

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OPERATIONS OF THE HORSE BATTALION, 15th (GERMAN) FIELD ARTILLERY, IN NORTHERN FRANCE, AUGUST, 1914. (Concluded).

BY LIEUT.-COLONEL A. SEEGER.*

Artilleristische Monatshefte, Sept.—Oct., 1921.

Translated by Colonel Oliver L. Spaulding, Jr., F.A.

Reprinted from the U.S. Field Artillery Journal. March—April, 1922.

THE days following the taking of Lille were, for the cavalry, only the beginning of a series of engagements, which continued until the great trench system was complete from the Swiss border to Nieuport in Flanders. Not until then was the cavalry gradually drawn out of the trenches and distributed among the armies, in reserve, or sent to the Eastern Front.

The General Staff compilation on the battles and engagements of the World War includes all the operations of the latter half of October under the name of the battle of Lille. In these hot actions the newly formed Sixth Army was struggling to hold what had been gained, and repulse the strong counter-attacks of the English and French, which had as their object to assure possession of the ports of Calais and Dunkirk, as a base for their shipping on the Channel. The German troops engaged were the 7th, 13th, 14th and 19th Army Corps, the 25th and 48th Reserve Divisions, and all the effective cavalry remaining on the Western Front.

At this same time operations were extended farther northward, by the battle of the Yser in the last half of November. Here fought the "young regiments," mentioned in the bulletins of October 21st as going into action singing "Deutschland über alles." These were the troops included in the mobilization plans as the last and youngest drafts of the 22nd, 23rd, 26th and 27th Reserve Corps, composed of volunteers, mostly students, who had joined the colours in August and received a special training of only two and a half months. Naturally their instruction was far from complete; their infantry armament was up-to-date, but their artillery was weak, and inferior in both training and armament. The batteries had only the old laying apparatus—a disadvantage from which many of the newly formed batteries of 1915 suffered, seriously affecting both rapidity and accuracy of fire.

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Artillery ammunition was short, causing much anxiety in some cases. It was very strictly rationed, and sometimes, in active operations, a battery was allowed only from thirty to fifty rounds a day! One may readily imagine that the infantry got but little effective support.

On the 18th, 19th and 20th the 7th Cavalry Division was designated as reserve for the 26th (Würtemberg) Infantry Division, in action west of Lille, but was not called upon. We remained inside the old ring of forts, at Haubourdin, looked to our shoeing, our equipment and our ammunition supply, caught up with our neglected diaries, and wrote to the depôts for our much needed replacements. Up in front, the gallant Swabians of the 125th Infantry were fighting for possession of the Radingham chauteau. On the 21st we moved north again, and passed through Lille at daybreak in several columns, noting as we passed the great damage done by our artillery fire in the neighbourhood of the railway station, while the citadel quarter was uninjured. We moved by Wambrechies and Quesnoy-sur-Deule, and about noon entered the Lys valley south of Comines, where we halted to await orders to go into line. Here on the Franco-Belgian border, and about to go into action, it was found that we had no maps, and we had to get them from the troops that we relieved. These were on a scale of 1/300,000, and were inadequate for the position warfare that was beginning. We took over the positions of Bavarian horse artillery, which moved a few kilometres farther north to take part in the fighting east of Ypres. One battery to a kilometre front was about all we could get then, while the next year there were fifteen or twenty to a kilometre on each side.

We should have had the new Belgian 1/60,000 maps, taking the place of the French 1/80,000. For lack of them, my batteries were unusually clumsy in getting into position, and came under long-range shrapnel fire while moving up. My own staff got its share of this fire, and had to move by the flank at a gallop, across country. Here we had an object lesson of the value of good jumping horses, but found unexpected difficulties with the broad muddy Flemish ditches. The poorer jumpers refused to take one of these, and the rest of us, who had found cover on the other side, could do nothing to help them; we had several men wounded, and a horse killed. I could not help thinking of the time we had spent in training horses and men to take hurdles, when as a matter of fact they are not nearly so much of an obstacle as ditches. One can generally get around them somehow, but water courses are different.

As a lieutenant, I always wondered if this training was not overdone. Putting draught horses over hurdles merely teaches them something that they can never use. The horses that were best at these water jumps were those that came out of my 2nd Battery, which had been trained under that splendid horseman von Chappuis. As I have already noted, this characteristic persisted in that battery almost to the end of the war—at least, as long as there remained many of the old horses.

Between Tenbrielen and Houthem all three batteries found positions facing Zandvoorde, which was visible from a great distance, and which the English seemed to be preparing for obstinate defence.

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The country was typical Flemish plain, much cut up with hedges and watercourses. It was much easier to find a gun position than an observation station. For this purpose we found the numerous scattered farm buildings best, for the enemy's artillery had not yet got into the habit of taking them as its first target. One after another, these buildings disappeared, and within a year the whole appearance of the country had changed. I came back to this once pleasant region in January, 1916, and could not find my way by the map; new roads had been built by Russian prisoners out of the ruins of the villages; great camps had been built; and where our batteries had been hidden in October, 1914, there were sheet iron buildings, drill grounds, and the whole fortification system of the second and third lines. This was especially the case in the neighbourhood of Tenbrielen and Houthem. Throughout the war this country was the scene of heavy fighting, not less notable than that at Verdun and on the Somme for obstinacy, and for the numbers of men engaged and the amount of ammunition expended.

The inhabitants had for the most part remained, except in the actual fire-swept areas. The Flemish peasants seemed to prefer to share the risks of war with our soldiers, rather than leave their homes prematurely. In many places they had to be driven out by force. Our relations with the civil population were very good, much better than in the French speaking parts of Belgium. Our Rhinelanders and Westphalians found their dialect very similar to Flemish, and readily established friendly relations, much to the advantage of both parties.

Our cavalry skirmish lines were now established in the swampy trenches, only a few hundred metres from the enemy who was generally quiet enough, but on the alert to take advantage of any exposure on our part. But we could never get a look into the English artillery positions; we had no air observation, and could do nothing against the enemy's guns, beyond the hills. The cavalry commanders were always complaining of us, and demanding impossibilities; they could not understand that the conditions that we were now meeting called for methods of reconnaissance and combat that were not in our textbooks. The trouble was not in the troops, who did their very best to accommodate themselves to the requirements of trench and position warfare, but rather to the novelty of the situtation, and to failure to develop our artillery along the right lines before the war. The enemy was pretty much in the same situation, but we cannot deny that he had a certain advantage in his means of observation, particularly air observation. It was not until much later that we succeeded in getting our eyes off the ground well enough to be again masters of the situation.

My guns often worked up very close to the enemy, but did not gain very much by it. One of our cavalry commanders said that he would not be satisfied until they were all in the skirmish line! He had no idea of the proper use of our arm, nor of the danger of losing guns—we had only twelve in all—if the enemy should break through our thin line some night. Again and again I, as the senior artilleryman, had to bring up this point of view at division headquarters.

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We could see, and constantly reported, that Tommy was rapidly making all this Ypres country into a fortress to protect his seaports; nevertheless, late in October, an attack was ordered with inadequate strength, and with only such artillery preparation as we could give with light guns and little ammunition. The result was a discouraging failure; we lost many men in front of the enemy's wire, for with his commanding position and good field of fire his defense was easy. The attack had been intended to assist another in the adjoining sector, at Gheluvelt and America Farm, where more and more Germans were coming in to attack Ypres from this side. But four years later we were no further ahead. We watched the beautiful old city gradually fall into ruins, saw stone after stone, tower after tower, crumble, but we never got into it. Ypres remained an unattainable goal for us, although its capture would have been only another "ordinary" victory if we had not pushed clear on to the coast. And yet our cavalry had been there in August, and again in September, when the whole country was clear and no one dreamed of a "race to the sea"; when one might have gone almost unopposed to Dunkirk, to Gravelines, and even perhaps to Calais!

How different things might have been, if Fate and the Reichstag had given us a stronger army on mobilization! A few additional corps, and we might, without weakening the main force marching upon Paris, have gained the coast by rapid marches, and upset the whole English and French war plan.

We remained only a week in the Comines—Wervicq—Ypres region. We were relieved to put stronger troops in our place, to co-operate with the newly formed reserve corps in an attack upon Ypres. After our departure the 38th Landwehr Brigade and some of the Rifle battalions took the strongly fortified Zandvoorde position, after bombardment by 15 and 21-centimetre batteries. Our division, which had been given a few days' rest near Roubaix, allowed us to visit the position after its capture, and we particularly noted the great effect of our heavy calibre fire, and the slight effect of field guns upon such strong works. It almost made us regret every shot that we had fired, other than those at living or moving targets; in those days artillery was expected to fire as long as it was in position, whether there was any prospect of effect or not.

During the five days that we spent about Roubaix and Turcoing, we found not only good quarters and tables, but also reasonably satisfactory relations with the people. The war had not yet touched this country, and everything was as in time of peace. The land was cultivated, and the factories still running in some places. The large factory owner with whom we were quartered, expressed great anxiety, fearing that the German supply officers would take over his large stock of supplies of all kinds. We, who were to be his guests for a few days only, assured him that we would not touch anything; but that the Line of Communications would find everything, and take whatever was needed for the army.

On November 3rd we celebrated St. Hubert's Day, according to the old cavalry custom, with a hunt near Turcoing, where the country was very well adapted for it, and all mounted officers took part. Later there was a jumping competition, and Lieutenant von

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Chappuis' horses, prize winners at the International Horseshow at Malmö, were easy winners. In the evening there was a banquet in honour of the day at the chateau.

The next alarm came at a most inopportune time. We were busy with replacements and remounts, and with dismounting our guns after their hard service, when in the night of November 3rd—4th we were called to Warneton to relieve the Guard cavalry. The staff went ahead in automobiles to reconnoitre positions, so that there might be no delay in occupying them at night.

We were assigned to the region just south of Messines, which had already been the scene of many bloody battles. In front of us lay Ploegsteert wood, later so famous. Little digging had been done, and there was no position, properly speaking. The enemy had been encountered here only a few days before, and we had been unable to push further west, or to capture Kemmel Hill, which commanded the whole country thereabout. It never was captured until 1918, and we had to give it up again in the summer of the same year.

Warneton, our division headquarters, was under heavy calibre fire by the English. The principal targets were the bridges over the Deule and the Lys Canal, which here forms the boundary between France and Belgium. We found ourselves in a "windy corner," for the fire was uninterrupted day and night, not only upon our lines but far into the rear areas. Communication with Lille, from which place we were supplied, was impossible by day, and even at night the fire on the main road was heavy enough to compel the construction of detours.

We went into position as before Zandvoorde,, and took over from the Guards all the telephone equipment already installed. Our colleagues from Potsdam had everything in good shape, and turned over to us good sketches of the enemy's positions. Our horse lines were, according to later ideas, dangerously near the front, often in the farms close to the guns or only a few hundred metres in rear. The limbers of one battery were even placed in the buildings of a factory near the Bas Warneton railway station, which was daily under shell fire. But at this time we had not become accustomed to the idea of sending the limbers miles away from the guns; we had too strong a horse artillery spirit to take kindly to separation from our horses.

So, in these last days of October and first days of November, the fight continued for Ploegsteert wood and Messines ridge. We supported the 52nd Würtemberg Infantry Brigade when it stormed Messines. Here a Würtemburg field artillery regiment especially distinguished itself, as related by Stegemann in his second volume. The 6th Battery of the 65th Field Artillery advanced its guns with the prolonges into Messines, under heavy fire; and, in spite of severe losses in men and material drove the enemy out of the houses by direct fire with howitzers at point blank range. The regimental history, published in the spring of 1921, mentions this as one of the most noteworthy exploits of the regiment. The battery commander, Captain Heuss, was killed in the village street, and with him a whole gun crew, while laying the piece.

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After bitter fighting, the village of Messines finally fell into our hands. But all the buildings quickly crumbled into dust; even in the two weeks that we spent there, we could see every day the effect of the guns of both sides.

Our Division with four cavalry regiments, had to hold a long line connecting Saxon and Würtemberg infantry troops; our strength was small, and the line too thin to stand a serious attack. Besides, our cavalry at this time had no bayonets, hand grenades, or other armament for close fighting on foot. Fortunately, no serious attack came, and there was little heavy artillery fire upon our light trenches, so that the losses were not great. But Warneton fell an unresisting prey to the enemy's artillery, and the staff there felt no security. A shell struck the house occupied by headquarters of the 26th Cavalry Brigade, and the roof of the church, which was alternately hospital and stable, threatened to fall at any moment. We were not over secure in our deserted brewery, but declined the offer of the division, to move artillery headquarters farther to the rear, for the situation made it necessary for us to be well to the front.

But we made no important attacks. Ploegsteert wood was soon developed by the enemy into an impassable obstacle. Farther north there was continuous heavy fighting on the high ground, where a determined effort was being made to get control of as much as possible of the Channel coast before winter. Our new divisions of the 22nd to 27th Reserve Corps, however, proved not to have the strength for this, and our enemies very properly credit this defense to themselves as a victory. General Buat, the French Chief of Staff, in his recent book on "The German Army in the World War," points out that we should certainly have been successful on the coast front, if we had had available in August the corps that we raised for the operations of October.

On November 21st we were relieved, after fourteen days in line. The 15th Army Corps had come up from the Aisne to take over the whole line south-west of Ypres. We had already fought with them in August in the Vosges, and now had the opportunity to renew acquaintance with these comrades from Alsace and Lorraine, who, in spite of their very mixed material, had a record second to none.

For about a week we had comfortable and quiet quarters east of Roubaix, between Tournai and Courtrai. This country was little touched by the war. Our predecessors here, the Guard cavalry again, were assigned to garrison duty, and went into winter quarters at Antwerp—a fate which fell to us a year later, when much against our will we formed a part of the Army of Occupation in Belgium, and remained for seven months from October to June, in Brussels, Namur and Liége.

On November 25th we got marching orders again. The division was assembled at Tournai for "a considerable march," whose destination, being unspecified, gave us a constant subject for speculation. We passed through Orchies, which had recently had to pay a heavy penalty for outrages inflicted upon our helpless patients in hospital there; then south of Valenciennes and by way of Le Cateau to Guise, still without any hint of where we were going. Finally, at Liart, we were told that we were to take train at Sedan. Thus we cut across

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the lines of communication of the whole German army, and for the first time got an idea of the work of the troops in rear, who collected all that the front lines needed.

On November 30th we passed through Mézières and Charleville, marching at attention and in our very best order, in case anyone should come from General Headquarters to look us over. But no one reviewed us; and except for many foreign military attachés, who watched us with the eyes of connoisseurs, we saw nothing of the machinery of command which was quartered in the old Prefecture, the splendid palace of Mézières.

Sedan having been given as our next stop, I seized the opportunity to take my officers for a ride over the battlefields of 1870, which I had visited and thoroughly studied in 1908, at the time of the first Morocco crisis. It was a pleasure to describe to my comrades the great drama of the heights of Illy, which on September 2, 1870, brought the first phase of the campaign to a glorious end, and set us on the way to the coronation at Versailles. In December, 1914, we were full of hope and confident of victory; none of us dreamed that the war would last so long, or have such a end. Only too quickly did the two days pass, before the trains were ready for us. I took my officers to Bazeilles, and to the heights of Frenois, where King William had received the sword of Napoleon; our quarters lay just below, and the traces of the fighting of the previous August were still plainly to be seen. I wanted to move my headquarters to the little Chateau of Bellevue, but was prevented by the town mayor of Sedan, who said the emperor's orders were not to touch that chateau at any time during the war. Looking back now, I doubt if the enemy would have been so considerate in our place.

We also visited the cottage at Donchery where the interview of September 1st, between Bismarck and Napoleon, took place. The old woman who had then owned it was still living there, and told us, doubtless for the thousandth time, of her experiences. In the visitors' book was the signature "William II—Sept. 14"; and the woman showed with much pride four gold pieces that the emperor had given her.

Finally, on December 4th, we entrained at Sedan, taking the "stirrup-cup" for our journey at the Croix d'Or, facing the statue of Turenne and the Prefecture, where Napoleon wrote his famous letter to "Monsieur my brother." Our destination was Saarburg! The fortune of war had decreed that we should return to our own garrison, and spend almost the whole winter in our own barracks. We did not go into the line for any length of time until June, 1915, and in the meantime were reserve for Falkenhausen's army; we were employed in several different places, but never left our station for long. I doubt if any other German troop unit had the same luck. We celebrated Christmas of 1914 in our own club; then, before New Year went to Mühlhausen in Upper Alsace to play a short engagement, returning home early in January.

We established ourselves in our own old quarters, very much as in peace time, got the best of rest for men and horses, and generally refitted. And thus ended, for us, the manœuvre warfare of 1914, at the same place where it had begun on August 2nd.

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ARTILLERY TACTICS IN THE WAR OF THE FUTURE.

By Oberst a.D. Freiherr V. Weitershausen.

Translation of an extract from "Militar Wochenblatt" Oct. 1st, 1922.

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

IT is a bold undertaking to discuss this matter when all further practical work with this arm is as good as forbidden to us. Hence these must be merely suggestions, collected from my own experiences and from the study of home and foreign literature.

We closed the world war with artillery tactics, which were entirely up to the standards of that time. How will they turn out in the war of the future?

The difficulty of using artillery properly in peace time manœuvres and in the paper battles of the war game, hinders the further development of the artillery. Hence the arm easily begins to lead a separate existence and to lose the esteem of leading personalities. Artillery tactics require a mass of technical knowledge, which one cannot acquire in the twinkling of an eye and, in addition to practice, a continual and thorough theoretical study. Artillery tactics is gunnery, and good gunnery involves well-digested knowledge. Good shooting is dependent on a suitable fire-control, which increases in difficulty with the varieties and calibres of the batteries. The world war produced the divisional artillery commander and the unified control by him of all divisional artillery. The higher commands reserved to themselves the control of the heaviest calibres only.

Now, during the world war, two new weapons came into existence, which will also influence artillery tactics in the war of the future, namely bombing squadrons and tank artillery. It seems to me that bombing squadrons are perhaps destined to take the place of heavy artillery and especially to undertake long-range fighting and the harassing of the back areas. Safety in construction of aeroplanes and their ever increasing capacity for carrying big loads will make them redoubtable fighting units. Therefore one must carefully study the question whether the construction of heavy calibres is still worth while and whether a bombing aeroplane might not be able to exercise a greater destructive power. If, however, the bombing squadron is destined to take over a large part of the rôle of the heavy and heaviest calibres, then its use will affect artillery fire-control and must be taken into account accordingly; otherwise a correct distribution of fire over the enemy position or attack is not possible.

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On the other hand, the increased importance of aerial fighting will make a stronger defence by anti-aircraft guns necessary. Each division must have A.A. artillery of its own at its disposal, which must be under its own A.A. artillery commander, since the tasks of this artillery and those of the fighting artillery have nothing in common.

Thus I think it possible that, in future, artillery will only retain medium and light calibres and be devoted simply to the infantry battle. I incline to this view, because, in future, gas-warfare, in spite of all efforts to eliminate it, will still play a great if not decisive rôle. But, in my opinion, medium and light calibres suffice for this, since their ammunition contains sufficient gas to cover areas quickly with a big concentration of gas, at a high rate of fire. I am classing guns up to 10 cm. calibre inclusive as light, and up to 18 cm. calibre inclusive as medium.

In addition to a high rate of fire, a long range must, of course, be insisted on. Batteries should have only three guns in order to be able to adapt themselves to the terrain as well as possible. Two guns are too few since, if one gun ceased fire, half the fighting strength of the battery would be out of action. Economical considerations may lead to the formation of 6-gun batteries, which then fall into two completely independent half batteries.

Every such half battery must have a signal section of 20—30 men, equipped with all the signal accessories of modern warfare. All staffs are correspondingly provided with signal sections, the size of which increases with the importance of the staff. Artillery can only work satisfactorily if it has perfect signal personnel at its disposal. This cannot be sufficiently highly valued. The staff of the artillery commander must include all the auxiliary formations, which are necessary for satisfactory fire-control, i.e. flash-spotting and sound-ranging sections, survey and mapping sections, meteorological section, artillery aeroplane and balloon detachments.

I suggest that the ammunition supply should consist of shells with instantaneous fuzes, about 50% gas and 50% for splinter effect. I would only allow about 20% shrapnel and that only for ranging on ground unfavourable for percussion ammunition.

In the light or battery columns, whatever they may be called, there must be a few lightly armoured tractors for the transport of ammunition, which can take supplies of ammunition to points of the battlefield which are under particularly heavy fire.

In addition to this battle artillery, there will be the tank artillery —used as artillery to accompany the infantry. This, with the Tank machine guns, forms part of every infantry regiment and is used and commanded by the regiment. Only so will the tank artillery be able to give the infantry that valuable help in the attack which they must have, especially at the moment when they have hurried past the effective range of their battle artillery and the latter, owing to the forward move of their positions, can only help them with part of their strength.

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The same is true of the counter-attack in defence. Here again tank artillery must accompany the infantry attack, to silence troublesome machine gun nests and other points at which an obstinate resistance is made. This, however, is only possible if it is part of the attacking infantry formation and is under a unified command therewith.

Thus, the commander of an infantry regiment with his tank squadrons, light trench mortars, etc., completely fills the part of the leader of a detachment of all arms.

Of the four big groups, which I have briefly indicated, battle artillery and bombing squadron must work closely together under the unified command of the artillery commander, anti-aircraft artillery works independently and tank artillery in close touch with the infantry.

The guiding principle of artillery tactics in the future war will still be to open the way to victory for the infantry, this is a warning to the infantry to make all their arrangements in close understanding with their artillery. Nevertheless. I thing that, in the war of the future also, infantry which attack with enthusiasm will run away from their artillery in the rush of the advance. But, after a longer warfare and after heavy losses, the infantry will only advance under the protection of heavy fire from their own artillery and their keenness to attack will diminish as soon as they get beyond its range. This phenomenon was noticeable amongst the German infantry even in the Loire battles of the 1870-71 war and in still greater degree at the conclusion of the world war.

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THE SURVEY OF AN AFRICAN DEPENDENCY.

BY LIEUT.-COL. R. H. ROWE, D.S.O., M.C., R.A.,
Surveyor-General, Gold Coast Survey.

THE days of sensational exploration in Africa are over. The general outlines of the geography of that continent, once described as "dark", are now well known. Accurate details are still lacking over large tracts, often inhabited by untamed and warlike tribes, but for the most part now reduced to order under the *Pax Britannica*.

With the advent of peace, and consequently prosperity, a new era in our West African dependencies has opened. Railways are rapidly being built, new avenues for the collection of valuable produce, required by the world, are constantly being made, revenues are correspondingly growing and providing funds for further expansion.

It is generally considered that our Colonies in Africa are a source of expense to the tax-payer and a question constantly asked is whether our West African Colonies are "worth it." It will come as a surprise to many to be told that they are entirely self supporting, raising their own revenues from customs duties and other sources, and not costing the British tax-payer one penny. Unlike such countries as "Mespot". and "Palestine", they do not receive millions from the home government, and even when raising loans for large work, they do so entirely on their own responsibility and on their own security.

Moreover, their trade with the Home Country and their valuable resources in palm oil, coca, ground nuts, and innumerable other commodities, are invaluable to us. These Colonies also absorb annually vast quantities of cloth and other manufactures, and give large orders for railway and other materials, thus providing employment for thousands who would otherwise be out of work.

The extraordinary development now in progress has only come about during the last twenty years or so and is hardly yet realised. New requirements have sprung up in consequence, in the Colonies themselves, of a nature and magnitude that would have appeared unbelievable but a few short years ago. Luckily for the prosperity of these countries they have been for the most part governed by men of great breadth of mind and foresight. How well they built the foundations of prosperity with an instinctive grasp of the future is now beginning to appear. The names that come to mind first of those who will always be associated with this remarkable development in West Africa are Sir Frederick Lugard, Sir Walter Egerton, Sir Gordon Guggisberg and Sir Hugh Clifford.

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Among the requirements rendered urgent by this rapid and recent development is the necessity for good maps. The time for the gallant explorer's sketch, with its line across a sheet of otherwise blank paper, showing his intrepid journey through unknown country, has passed. The advancing roads, railways and other works, the details of administration and scientific development require accurate contoured maps on a proper system, such as has been developed to such perfection by our Ordnance Survey of England. The production of these requires a properly organised survey department with skilled surveyors and experienced supervision.

The first organised survey in West Africa, as an essential department of the administration, was initiated by Major (now General) Sir F. G. Guggisberg in Nigeria before the war. A considerable portion of Nigeria was surveyed before the war broke out, causing the work to be discontinued, but valuable maps had by then been produced. In the Gold Coast, as Governor, he has instituted an organised survey department which is producing topographical maps of a high standard.

The surveyor engaged on making these maps has a difficult and strenuous task to perform, especially in a country such as the Gold Coast, which is, for the most part, covered with dense and almost impenetrable tropical forest. Conditions of life in this country have undoubtedly improved and, for many who live and work in the big centres, an almost healthy civilisation is now attainable. But the surveyor has to work in the unopened tracts, cutting his way through the forest, camping and sleeping where his traverse may happen to finish at dusk, whether the spot is healthy or not, without any of the carefully planned prophylactic measures that are making larger centres so vastly more healthy than the "bush".

The surveyor has many troubles to contend with which are not met in other countries. His chief difficulty, the vast and dense tropical forest covering the land he has to survey, has already been mentioned. During June to October there are torrential rains. From December to March the country is covered by a thick dusty mist known as the "harmattan", which prevents distant view from the few points obtainable. During the dry winds, the woodwork of his boxes, instruments, tent poles, etc., shrink and splits only to swell up again in the damp of the tropical rain. So bad are the rains that during the worst portion of them, from July to September, field work has to be closed down. Technical methods, too intricate to be described here, have to be adapted, as have also the instruments, to meet the special nature of the country and its climate. Minor troubles are snakes, malaria, mosquitos, scorpions, and other pests. Malaria is contracted through the bite of the mosquito and at night all Europeans sleep under mosquito nets. The jigger is a pest chiefly met in the coastal districts, and is a small flea which burrows and lays eggs under the toe-nails and requires careful and expert extraction to avoid unpleasant consequences. "Tumbo" flies, somewhat like large house-flies lay eggs in the skin which subsequently hatch out in an unpleasant boil. The guinea-worm, another enemy, is accidentally consumed in drinking

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water. Eventually, after unknown wanderings, it appears in the shape of a lump in the legs from which, on wading through a river, young guinea worms are projected into the water, to again be drunk by some animal, and so go through the same cycle. Needless to say that in the case of surveyors the latter part of the cycle is incomplete, and the guinea-worm finishes its existence by being slowly wound out on to a match.

It will be seen that the surveyor has to combine robust health with scientific skill of no mean order and must have special tropical training for work in West Africa. He has also to live nearly all his time alone, assisted by his native gang. He has to learn to manage and load natives, and even to doctor them when ill and away from any centre where medical skill is available. From time to time his "section officer" will meet him at some pre-arranged spot, receive his reports, inspect his work, and generally see that all is well and that he has everything he requires.

He has to carry everything with him. His loads, weighing about 60 lbs. each, are carried on the heads of "porters" or "carriers". If he forgets to take anything with him (such as matches or soap), he simply has not got it, and cannot get it. Preparations for the start of the "field season", as it is called, are therefore somewhat elaborate, and very carefully organised, so that no delay or hitch may stop the work.

The technical programmes are very carefully thought out some months ahead by the "Director" and his "section officer". The whole topographical survey is divided into sections, and each section is again divided into field camps in charge of a European surveyor who has his programme of work issued to him, and he is made responsible for a particular area of the country that has to be surveyed.

In surveying, time is money. The longer a man takes to properly complete a given piece of country the larger the expense to Government in the salaries of carriers and other expenses. Provided always that the proper standard of accuracy is maintained, the quicker a surveyor can complete his work the better, a good man being thus more cheaply obtained. In organised survey work elaborate statistics as to speed and accuracy are part of the routine. Weekly returns are carefully scrutinised, and the work examined on the ground. Any failure on the part of a surveyor to produce a reasonable output of reliable work would at once become apparent. It should be pointed out, however, that the work is so interesting and the map so much the result of individual labour that surveyors are almost always enthusiasts, and take the greatest care and interest in the area allotted to them.

The surveyors in the field, who are producing the very creditable maps now available for public use, work in very difficult conditions, and their loneliness and the unpleasant nature of their camping grounds is often indescribable. They are not able to do their work in the improved cantonments about which so much has been said recently in regard to improved conditions of the West African workers, but must

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live and sleep in the forest where their work takes them. Perhaps it will be realised in the near future that their good work is at least worth as much praise as the intrepid explorers of hardly a generation ago.

MAKING THE NEW MAP OF THE GOLD COAST.

The Topographical Survey parties engaged on the production of the new topographical survey of the Gold Coast return for their third field season in West Africa in October this year. Progress has been so rapid that the coming season will practically complete the maps of the "Colony" itself and a large area in Ashanti as well.

About 15,000 square miles has already been surveyed and the final printed maps on the scale of 2 miles to the inch are now coming to hand. An inspection of those maps will reveal the very large amount of detail work that has been embodied in them. The maps compare well in their clarity and completion with the ½-inch Ordnance Survey Maps of England, and show not only every village, stream, hill, road, etc., but telegraphs, post offices, missions, markets, and much other detail, together with a complete delineation of hill features by form lines at an interval of 50 feet. The importance of such maps to the administration and development of the country is obvious.

The Survey Department of the Gold Coast was closed during the war. The present Governor, Sir F. G. Guggisberg, K.C.M.G., D.S.O., resuscitated it in 1920, and, finding matters very backward owing to the entire cessation of work for such a lengthy period, strengthened the department for a limited number of years to enable it to cope with the immediate needs of the Colony. By 1924 the country will have more than regained its position in this respect and is now being provided with an up-to-date survey such as is essential to modern developments. The importance of this work, and the necessity of removing as soon as possible the existing confusion as regards boundaries, is now fully realised, and such interest in the work is evinced by the chiefs and the educated native community.

On the retirement of Major H. A. Lewis-Hall, M.C., R.E., who was responsible for some excellent maps of a portion of the Northern Territories, General Guggisberg entrusted the re-organisation of the new department to Lieut.-Colonel R. H. Rowe, D.S.O., M.C., R.A. The officer placed in immediate charge of the maping in the field was Major G. H. Bell, M.C., who applied himself energetically to the training of new personnel that had been collected to undertake the work. The parties were organised in three sections, respectively in charge of Capt. G. Cheetham, D.S.O., M.C., R.E., Major C. G. Woolner, M.C., R.E. and Capt. S. C. Saward, M.C., M.M. These sections, after re-fitting in England during the "recess period" from July to September, leave for the coast in three successive mail boats. This year they will land at Seccondee, and arrangements are completed for them to proceed immediately to the areas in which they will be working, the latest being round Coomassie.

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The three sections are each divided into several "field camps", each a complete unit with its own outfit and labour, and its own particular portions of the map to complete. Their work is constantly supervised and examined on the ground by their "section officer", who thus satisfies himself that all work done is up to the standard required. One of the most important rules of the department is that every line of the map is carefully drawn with the actual ground before the surveyor and all computations finished and checked in the field.

The country that has been surveyed during the last two field seasons, has been, with the exception of some small portions, very dense tropical forest of the most difficult description from the point of view of the surveyor. It is necessary, however, for the running of roads and railways and other developments that the shape of the ground should be ascertained. Much of this country is trackless forest, and lines must be cut through it by the parties in order to delineate the features. Such work is no easy or rapid task, as may well be supposed, but, as can be seen from the maps, has been carried out with skill and vigour.

It should not be forgotten that the great improvements in sanitation and comfort, and consequently in health, so often spoken of nowadays in connection with West Africa, is chiefly in the large centres and has little bearing on the work of surveyors in such surroundings, cutting their way through the tropical jungle and obliged to camp, work, and sleep wherever their traverse happens to finish at the end of the day. Also by the nature of things the surveyor is alone in these surroundings day after day, except for an occasional meeting with the surveyor engaged in the adjacent area, and the visits of his section officer to inspect him.

An important portion of the new Survey Department initiated by General Guggisberg is the Survey School at Odumase, where African surveyors are being trained on the same lines as the similar schools inaugurated by him in Nigeria, and which have proved so immensely successful. An African surveyor is passed out of the school after three years' training, after which he serves for four years with the Government and is then at liberty to open up in private practice for himself. There are good openings in this profession for a really good preliminary education. Two African surveyors in the department have recently risen to appointments in which they are drawing £400 per annum and carrying out technical work of a high order, previously done by Europeans.

In addition to the Topographical Branch of the survey there are two others, the Cadastral Branch and the Records and Reproduction Branch. In the Cadastral Branch, which is directed by Mr. J. Clendonning, B.Sc., A.M.I.C.E., a great amount of work has been carried out in the shape of large scale town surveys, land surveys, and the delineation of stool boundaries. A "lands officer" has recently been appointed to the branch and he is engaged in putting together very complete records of transactions in land for the use of the general public, a matter that has previously suffered from neglect, there being no lands department or commissioner of lands in the country.

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The basis of the Cadastral survey is a new framework of co-ordinates based on a system similar to the Egyptian survey, but embodying the latest and most up-to-date practice evolved by experience. The effect of this will be fully felt in years to come, when development increases, and confusion, and delay will be avoided by having a regular and well organised system from the beginning, a boom known to very few of our colonial dependencies.

In the Records and Reproduction Branch a very complete system of records has been inaugurated. Many colonial surveys have suffered in the past from lack of complete records, involving in consequence much re-survey and unnecessary expense. The present records are very complete and enable gazetteers and other books of reference to be published, giving all information as regards towns, villages, routes, water supply, accommodation, etc. The Reproduction Section is engaged in the printing in the Colony of useful maps and diagrams, such as numbered road maps, (showing the road organisation and motor routes), statistical and other maps.

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The New Map of the Gold Coast: A Field Survey Camp Ready to March.

The New Map of the Gold Coast: A Field Survey Camp on the March.

The New Map of the Gold Coast: Meal Time on the March.

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HOW SHALL WE SHOOT OUR BATTERIES
or
HOW SHALL WE NOT SHOOT OUR BATTERIES.

BY MAJOR H. E. KENYON, D.S.O., R.G.A.

IN the September number of the Journal there appears an anonymous article, under the title "How shall we shoot our Batteries".

It leads up to the decision that the Wason Code is far quicker and simpler than the old Artillery Code.

This is of particular interest as there are still a certain number of all ranks who are doubtful as to the suitability and reliability of the code.

It may be presumed that the author is an advocate of the code himself and is of opinion that it only requires practice and familiarity to attain rapid and accurate coding and decoding.

In the examples taken we will presume that the author is the encoder, the printer the sender, and the individual who checked the proofs (in this case presumably the author, which gives him an unfair advantage) the receiver.

Apart from one or two codes, which appear to the writer to be open to discussion, I submit that in the first example there is one error and in the second example five errors.

If decoded as they stand they would read as follows :—

Intended order.	Order given by G.P.O.
4 rounds gun fire 40 seconds.	Cancel last two groups. Gun fire 40 seconds.
Target Infantry.	Concentrate 1 deg.
3300. 2 rounds.	33. (H.D. not in the code.)
Corrector 140. 2 rounds.	Corrector 140. 86.
Drop 200. 6 rounds.	"Points of Fuze" 6 rounds.
Gun fire. 10 seconds.	Gun fire. Corrector 130.

This merely shows how easy the code is when worked out quietly in one's room and does not allow for the far more difficult conditions when actually conducting a shoot.

I am not opposed to the code myself but I think that the original article shows the pitfalls into which the wary, apart from the unwary, may fall even under the most favourable conditions and accentuates the absolute necessity of constant practice by all who may at any time be called upon to use it.

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THE RELATION OF POLITICS TO WAR.

A Lecture delivered at the Royal Artillery Institution, Tuesday, 17th October, 1922.

BY SIR EDWARD W. M. GRIGG, K.C.V.O., C.M.G., D.S.O.

Major-General Sir W. Gillman, K.C.M.G., C.B., D.S.O., in the chair.

CHAIRMAN: Lord Horne and gentlemen, I want to introduce, to those of you who do not know him, Sir Edward Grigg, who has very kindly come down here to-night to talk to us about the Near Eastern Question and the relations in connection with it of policy and strategy. He had an exceptional career in France, ending up as G.S.O.I. of the Guards' Division and, apart from his connection with the Prince of Wales, he is now Private Secretary to the Prime Minister. He therefore has an unrivalled opportunity of talking to us from both points of view.

I will ask Sir Edward to go on with his lecture. (Applause.)

SIR EDWARD GRIGG: Lord Horne, General Gillman and gentlemen, you may have read in the papers of the political crisis which is going on. I mention it now, not because I propose to lecture about it but because I hope you will ascribe it to that crisis rather than to me that my remarks to-night are not as fully prepared as I should have wished when appearing before an audience of trained soldiers like this, many of whom have had great experience.

I want to discuss the Eastern Question and to discuss it from the point of view of the relation of policy and strategy. If you look back at the Great War, you will find that we had an excellent doctrine as regards the Western Front—a doctrine from the very start. Whether our preparations on the Western Front were adequate or not does not alter the fact that we had this doctrine and when war broke out we knew exactly what we ought to do in defence of our interests. That doctrine was, I believe, of immense value to us from the very start. If you turn your eyes at the time of the opening of the war from the Western Front to the Eastern Front, you will see a very different picture. Our policy, so far as one can judge by looking back at it now, certainly lacked a guiding principle; we were not quite clear what we were at and our military plans for dealing with that aspect of the war were at the outset at any rate half-baked—we went by fits and starts, not knowing exactly what we were trying to do. There is always a danger that we may revert to that state of mind in regard to the Eastern Question, and it is from that point of view that I want, if I can, to speak about it here to-night.

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Just think of the mistakes we made with regard to the Eastern Question at the outset of the war. The first thing we did was utterly to fail to realise the importance of keeping Turkey out. It seems extraordinary, on looking back at the records of the times, the way that the "*Breslau*" and the "*Goeben*" got away to Constantinople by an unfortunate concatenation of events, but still they got there. We hardly knew how closely the German plans and the Turkish plans had been drawn up together before the war and we entirely failed to appreciate these movements at their proper value. We seized the Turkish men-of-war which were building in England, in fact we did almost everything to persuade Turkey to go into the war against us.

That was the first thing. The next thing we did was that we went to Gallipoli, finding that the Straits were of importance to us, after telling Greece, who was anxious to come in on our side, that we had no need of her military assistance.

The next thing we did was to fail to realise the immense importance of helping Serbia and we allowed Serbia—to get wiped out. Then, on top of all that, we alienated Bulgaria.

Now I have no doubt that there are excellent explanations for all these events, but what they did was to present us with an appalling series of additional problems in the war and I think they protracted the war by many months. It is possible, as I say, that you may get back to the same sort of problems, the same sort of difficulties, now unless we get down to a doctrine, a clear doctrine, about the Eastern Question similar to the doctrine we had about the Western Front in 1914.

I would like to give you one final example of how extraordinarily unthoughtout our plan with regard to the Eastern Question was in 1914. When the policy was being discussed there, almost the first thing we did was to sign a treaty with Russia ceding to Russia control of Constantinople and the Straits in the event of the victory of the Allies. To look back to that now takes one's breath away. We were ceding, just in the crisis of the war, a thing we had fought one war to prevent, which all our policy during the previous half-century had been directed to prevent, and which we are now obviously as deeply concerned as before to prevent. It is extraordinarily lucky for us that Russia broke down and that that bargain of its own accord collapsed.

What is the Eastern Question which we are facing now? There is a good deal of confusion about it. One hears a good deal of comment about the Turk being a gentleman and the Greek being a worm, and why do we not get on with the gentleman and leave the worm alone and so on? There is truth in that. The Turk is a member of a governing race; he has been a governing race for centuries and we instinctively feel a kinship with the Turk for that reason. The Greek is a member of a subject race; he has been a subject race for five hundred years under the Turk's heel and he has not escaped the vices of a subject people. Our instincts in that matter are natural, but those are not adequate foundations for policy. I often heard the comment in the war

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that the German was a much better fighting man than the Belgian. That did not make us change sides, but there it was.

Another thing one hears about the Eastern Question at present is an argument to this effect: We have got all sorts of land frontiers in the Middle East and in order to hold those land frontiers, in order to pursue our present policy in the Middle East, we must be friends with the Turk; let us therefore, whatever it costs, be friends with the Turk. Now there is a great deal in that too. It is perfectly clear that friendship with the Turk is much better for us than his enmity, but again that is not an adequate basis. What you have to get down to in this question, as in all others, is to put aside the question whether you like this Power better than that Power and whatever momentary sentimental considerations there may be in the way of international friendships, you have to get down to the solid British interest and pursue that. If we could get a clear doctrine on that, we would be much safer in future dealing with the Eastern Question.

Now I have spoken of the Eastern Question in a vague way. What is the Eastern Question? The Eastern Question has been gradually growing up for something like a century. It begins with the gradual expulsion of the Turk from Europe. As you all know, the Turk had an astonishing series of victories for about a century and a half and gradually conquered the area of the greater part of South-Eastern Europe. About a century ago his power, which had been waning before, began to give way rather fast. You had the rise to independence of the Greeks and you had after that the series of risings of nationalities which had been practically entirely submerged by the original Turkish invasion— nationalities such as the Bulgars which had ceased to exist even in name. In the early part of that process of the expulsion of the Turk from Europe we took only a sentimental interest in it. We took a very considerable sentimental interest in the revival of Greece based mainly on our classical education and our interest in ancient Greece—Byron as you know went and fought for Greece and died out there—but as the process of the Turks' withdrawal from Europe continued, we began to realise that a great British interest was beginning to be endangered. How rapid the process of the Turk's withdrawal was you can gather from the fact that after the Napoleonic Wars he still held 200,000 square miles of European territory and governed 20,000,000 of European race. By 1914 when the Great War began he governed only 10,000 miles of European territory and only about a million and a half of European race. The problem thus presented to us was this: As the Turk weakened it became perfectly clear that he could no longer be trusted to hold for ever the immensely important country on the European side of the Dardanelles and the Bosphorus, and all the great Powers became possible claimants for that—which is one of the most important strategic points in the world. Our policy all through the latter part of the last century, when we realised the coming demise of the Sick Man, as the Turk was then called, was to back up the Turk against our greatest bugbear at that time, the Russian. We fought the Crimean War for that purpose and that was the purpose in con-

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nection with which Disraeli and Lord Salisbury returned with "Peace with honour" from the Congress of Berlin in 1878. That was our policy steadily up to the end of the century, but at the end of the century we began to have doubts and it was in 1898 that Lord Salisbury made the famous remark that he was very much afraid that we had "backed the wrong horse". From that time our policy was on the whole uncertain. We tried to be friendly with various Balkan Powers who were struggling against Turkey, as well as to remain friendly with the Turk himself and you remember the confused mixture of political events and wars during the first twelve years of the twentieth century—Balkan wars in rapid succession, Greece and Turkey, Serbia and Bulgaria and so on. We tried to be friends with both sides, and we were never clear what we wanted to get out of it.

Then came the Great War. Now why was the eventual destination of this bit of land here in the Straits of such importance to the British Empire and is it important still? I think there are three big reasons why it must always be of vital importance to us. The first is the commercial reason. If you look at the Black Sea, it is not so very much smaller than the eastern end of the Mediterranean between the Isles of Greece, the southern coast of Asia Minor, Palestine, Egypt and Tripoli. It is infinitely richer than *that* part of the Mediterranean. Roumania and the Caucasus are great oil-producing countries; all *this* area is a very rich corn-producing country, and not only that but as Russia develops, by far the greater part of the wealth of Russia must find its outlet to the world through the Black Sea because, as you know, Russia has no free ports up in the north. They are mostly icebound and with nothing like the same commercial importance as those in the Black Sea. Our trade with the Black Sea before the war amounted to millions of tons of shipping going through the Straits every year; I think the total shipping was something like 12,000,000 tons in 1909 the last figure I came across, and our share of that was six and a half millions, more than half.

We realised in 1912 when Italy was fighting Tripoli what the blocking of these Straits meant to us in the way simply of commercial loss. Turkey when fighting Italy closed the Straits because she was afraid of a naval attack on Constantinople, and the result was that our ships were hung up in the Black Sea. I was looking back the other day at a debate in the House of Lords on the subject in which Lord Morley and Lord Lansdowne were the two chief speakers, neither of them fire-eaters or Imperialists, and both of them spoke of the tremendous damage that was being done by this blockade. Therefore you have a very strong commercial reason for keeping a free access to the Black Sea and keeping the Black Sea itself, the salt water, open to the trade of the Empire. Salt water is our special element and without the trade of this region we should be enormously hampered in our recovery after the tremendous losses of the war. It is one of the great fields of trade which we have to look to. The freedom of the Straits therefore means in the first place freedom for our merchantmen to trade backwards and forwards into the Black Sea, and freedom for

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the merchantmen must mean for us freedom also for our men-of-war.

That brings me to the second reason why this narrow strip of salt water is of such immense importance to us. Supposing our ships, our men-of-war, the ships of the Royal Navy, were not free to use the waters of the Black Sea, it is obvious that the whole of our trade here would be at the mercy of any Power, whether it were Russia or Turkey, or any Power which developed sufficient naval force in the Black Sea to threaten that commerce; it would be always at the mercy of any naval force in the Black Sea and we should be without the power to protect it. Not only that, but the Black Sea and the Straits are a place where immense resources can be concentrated for the creation of a navy. You have got all the main constituents there; you have the oil and of course all the resources of the Continent for shipbuilding there. It is possible that you might have a great navy created there. Russia had a considerable navy there before the war. Such a navy would enjoy the whole of this vast area as a kind of naval sanctuary—a sanctuary which would dominate our main sea route to the East. That is a position of naval advantage to our possible adversaries which we must try to prevent at all costs.

I have given you two reasons, the commercial reason and the naval reason, but I think a stronger than either of those, strong as they both are, is the military reason, and the military reason brings me to the policy of Germany before and during the war. This map is a German map issued in 1916 as an explanation to the German people of German war aims—the chief German war aim. That aim is very clearly shown by this green line you see right across the map. That green line represents a railway from the mouth of the Elbe through Hamburg to Berlin and then down to Vienna and then through Hungary, Budapest and through Belgrade and Sofia down to Constantinople, then across the Straits and joining up with the Baghdad and Hedjaz Railways. The German dream was to get the control in the first instance of this route to Constantinople and the Straits, with the object of course of being able to concentrate there with great rapidity any amount of military power. If you look at this little white bit of the map, or it may be light yellow, it shows where the railway crosses Serbia. The control of Serbia was an essential part of the German plan for controlling this great railway route to the East, and in that lies I believe—and most people I think now do believe who have studied it—the main reason why the Great War began with that curious incident in Serbia. Serbia had just strengthened herself enormously in the Balkan wars; the German could not tolerate that and an opportunity had to be found of crushing Serbia before Russia had the strength to save her.

I return now to the danger to us of such a posibility of concentration by railway in the hands of a military power. We realised it too late and it caused us immense difficulty in the war. It enabled Germany in the first place to bring a great concentration, by helping the Turks, arming and training them, down by the Hedjaz Railway against Egypt.

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That failed, but it nevertheless cost us a considerable depletion of strength to make it fail. That in itself therefore is a menace to our communications with India, but more serious than that is the danger that you might have a military power with direct access by land to positions dominating all this central part of the Mohammedan world and from there threatening our position in India itself, because if you will remember the Trans-Persian Railway was already a more or less practical plan before the Great War began, and it is morally certain that in due course that railway will be built. When that railway is built you will have a direct land route all the way from the north of Europe to the Indian frontier where India is not protected by any large mountain range.

That great aim of Germany in the war was, I believe, hardly realised by us when war broke out. I need not go through with you the various efforts which were made to deal with it; they were gallant efforts but many of them half-thought-out and they cost us immense sacrifices without in some places any result, for instance in Gallipoli. However, at the end of the war we achieved our great object. We had then absolute command of the Straits; we had the power in our hands of settling the future of all this territory, and we had, I believe, the opportunity of making ourselves comparatively safe in this great region.

It is getting very near controversial politics if I begin to discuss British policy in this region since the Armistice and I do not want to get anywhere near controversy or to refer to it in a controversial way. All I will do is to describe what the policy was and from that to go on to what confronts us in that great area now. The policy was a policy based mainly on promises we had made in the course of the war to the people who fought with us. The policy was in the first place to detach the Arab States from Turkey and to set them up as independent Powers so far as we were able with our protection and support. That part of the policy we have so far successfully adhered to although it is the object of tremendous criticism in many quarters at home. In regard to Asia Minor, the policy was much more complicated. South Western Anatolia had been promised to Italy for coming into the war. France had a special interest in Cilicia. Greece quite early in the war in the discussions which led up to what was called the Sykes-Picot Agreement had been told that she might have Smyrna which had at that time a population preponderatingly Greek. At the time of the Peace negotiations in Paris America—President Wilson—undertook to propose to his Parliament that America should take the mandate for Armenia and for the Straits, and on that basis Turkey, hemmed in all round by European Powers controlling the parts where there was any alien non-Turkish population, was to become simply a Power in the interior of Asia Minor where her main population is. Whether that policy was a good or a bad one, it has collapsed. It has collapsed in the first place because President Wilson failed to persuade the American Congress to carry out his part of the policy. When peace could have been negotiated with the Turks early in 1919, it was delay-

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ed because we were always—our representatives were always—told that it was essential to wait for the verdict of the American people as to whether they would take on these mandates or not. The result was that almost a year passed while we were waiting for the verdict of the American people. When it came, President Wilson as you know was defeated and that part of the policy immediately lapsed.

The next part of the policy which went was the Italian part. The Italians found that under pressure of unrest and economic and political difficulties at home, they could not afford to hold on to their part of Asia Minor and they began to retire from it by degrees; I do not remember when they finally vacated Adalia but it was fairly early in 1920. Then the French felt their position in Cilicia threatened and, unwilling or unable to bear the burden of maintaining their position by military means, they came to a separate agreement with the Kemalist Turks under which they withdrew entirely from Cilicia, leaving an essential part of this railway in the hands of the Turks. That agreement was not communicated to us at the time it was being negotiated but afterwards. There remained therefore of all the European Powers which had made this plan together, with commitments to each other, only Great Britain's Arab policy which was still going on and the Greeks in Smyrna—nothing else. We had certain obligations to the Greeks quite apart from the fact that we had originally been responsible for their going to Smyrna. They were invited to go to Smyrna in 1919 without the powers taking any responsibility for their being there.

They were told that if they could hold on there, if they felt they could make good, they were entitled to try, but none of the Allies took any responsibility for their presence there.

On the other hand at a later date just as the Kemalist Movement at Angora began there was a Kemalist military menace to Chanak and the Dardanelles. The Allied Generals met then in Paris, Marshal Foch, Sir Henry Wilson and an Italian General whose name I have forgotten, and they determined that it would be very inconvenient to the Western Allies to send troops to keep the Dardanelles clear and that we should invite the Greeks to do it for us. M. Venizelos was still in power then and he said "Well, I can do it if you understand that it means an extension of our front to Broussa and a greatly increased military problem for us there", and the Allies said "Yes, we understand that, but you will do a great service to us if you stop the Turks." The Greeks sent three Divisions and did stop the Turks and from that moment they were much further north than they had been at the start. We had always felt therefore that we had a certain obligation to the Greeks in Smyrna, but when the Greeks turned out the statesman who had risked his life and his political career in order to join the Allies in the war, Venizelos, and summoned back the Sovereign who had surrendered Fort Rupel to the Germans at a critical moment in the war, the original policy changed completely. We renounced all our obligations to the Greeks; we, the United States and France refused to pay to the Greeks money which we had undertaken to give her for the maintenance of her forces, and Greece was left entirely on her own.

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She has struggled on against great difficulties and I am afraid, as it now appears, with great folly and has landed herself in a military disaster which has cost her, not only Smyrna, but Eastern Thrace.

That is, I think, an uncoloured account of the facts which have led up to the situation which we are facing to-day. What is our problem now? It is perfectly clear, now that Eastern Thrace has been promised to the Turk again, that we are back with the old problem in the form which existed before 1914. I asked Mr. Morgenthau, the well known American Ambassador in Constantinople, who was there for many years before the war and, until America came in, in the war and who is one of the best living authorities on the Turks, how many Turks he thought there were altogether in the world—real Turks, and he told me it was very difficult to make quite sure but he had tried to test it by various means and that he had come to the conclusion that there were not altogether more than six million Turks in Asia Minor and in the south-east corner of Europe. You will understand that six millions are not likely to be able to stand indefinitely against the growing Balkan Powers which are always pressing towards the Straits. The old Balkan struggle is absolutely certain to begin again and we are confronted with the old question who is going to come in ultimately to the Sick Man's inheritance? We have made up our minds that for the moment there is nothing to be done now that the whole of the Allied policy here is in ruins, except to hold on to what is most vital from the British point of view. We are holding on to both sides of the Dardanelles and we mean to hold on there pending the Peace Conference which is to come off soon. The reason we hold on there is that we know very well that the important thing is to have these places in your possession actually while you are sitting at the Conference table. If you sit at the Conference table knowing that a place is yours and you cannot get the terms which you think are essential to your own interests, your situation is excellent; you break off the Conference and wait a little longer. If, on the other hand, before the Conference you have cleared out of this place saying simply "Of course we claim this place, but we will leave that to the Conference", where are you supposing the Turk refuses to recognise your claim to the freedom of the Straits—who is to turn him out? Are we going singlehanded into such a campaign as we undertook there in the Great War? Clearly not. Therefore we propose to hold there pending the Conference and until we get the best terms we can to secure the freedom of the Straits.

I am not sure that that will do anything, however good the terms may be and they may not be very good; it may be quite likely that we shall have to withdraw from that Conference having got nothing at all, and therefore we are determined to hold on. I do not know—it may happen so, but in any case supposing we get the best we are trying for, supposing we get the freedom here guaranteed by the League of Nations which will perhaps give certain powers of mandate to prevent the shores of the Bosphorus and the Dardanelles and the Sea of Marmora from being fortified on either side so that there is free passage not only for commerce in peace but for men-of-war—supposing we get

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that, that is not an arrangement that can be called certain to last. You will get again in Europe the pressure towards *that* point; you will get a tremendous pressure from these great Powers as they recover, Russia and Germany, with their secular aims pressing down *this* way towards the sea, Russia always pressing towards the Mediterranean; you will get these Powers perhaps in alliance or you may even get (the possibilities are infinite) other military powers determined to get control of that spot. Obviously we may do something to stave off that danger by political means. There is a great interest for us in a strong "Little Entente", that is to say Czecho-Slovakia and Serbia and Roumania, possibly with others: such a group would assist in keeping the great military powers out from *that* point. There may be assistance civil or political, in other ways, but we have to think out what our commitments are there supposing that position is threatened again. I spoke at the beginning of the lecture of the immense importance of a doctrine. We had a doctrine in 1914 with regard to the Western Front. I do not think we have got a doctrine, at least I have not heard of a clear doctrine, about our interests, commitments and liabilities here, and I am perfectly certain that one of the things which most requires to be studied now is what our strategy, what our military policy and what our naval policy is going to be in relation to our diplomacy in making that position absolutely safe for the British Empire. (Loud and continued applause.)

CHAIRMAN: Would any officer here like either to ask Sir Edward Grigg a question or to make any remarks on the excellent lecture he has given us?

MAJOR REYNOLDS: You said that in 1919, I think, the Turks would have more or less got at Angora. Was it considered an advisable plan to let them have their capital there with Constantinople on the other side of the Straits?

SIR EDWARD GRIGG: In 1919 Angora was not the capital; the Kemalist Nationalist Movement began early in 1919, but you must remember that the pressure to keep Constantinople in Turkish hands came from the whole of the Mohammedan world; it was not really Turkish sentiment but Moslem sentiment right through India and the East and there was tremendous pressure upon British Statesmen not to take the Head of the Moslem religion, the Sultan or Caliph, away from the place he had been in for four hundred years. As a matter of fact, as you know, there was a tremendous dispute about the subject at the time, and it was touch and go whether the Turk remained at Constantinople or not. It was finally decided by a narrow majority in Parliament that he should.

MAJOR REYNOLDS: Does it mean that he asked for leave to put his capital on the side of his territory?

SIR EDWARD GRIGG: There had been various proposals for making the capital safe. Some of the Military Authorities hold that the holding of the Chatalja line is adequate, while others say that you have to

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demilitarise some of the territory further west in order to make Constantinople secure. Those were all things which were discussed in connection with the various versions of the Treaty and at that time I think the Constantinople Turkish Government were satisfied, but the Kemalist Turkish Government were not because they wanted not only Constantinople but Adrianople.

LIEUT.-COL. WALLER: What is the meaning of the phrase "freedom of the Straits"? It seems to me that it means nothing at all because at any moment it could be broken. Would you kindly explain to us what is meant by the phrase "freedom of the Straits"?

SIR EDWARD GRIGG: One of the difficulties of the situation is that we are the only power which means something quite definite by it. We mean the freedom for merchantmen and men-of-war, and that means no fortification on either shore and if possible definite arrangements to prevent either shore being fortified. That is our meaning, but in the case of other Powers it means only commercial freedom.

CAPTAIN ASTLEY RUSHTON: You referred early in your lecture to the "Breslau" and the "Goeben" and to the effect which the escape of these ships had upon the coming of Turkey into the war. In the study of that episode there is one thing which strikes the student tremendously. The Commander-in-Chief in the Mediterranean so far as I am aware had no communication whatever from home as to the possibility of any such movement eastward and so had not completed his plans. Now before the war, I take it that our Ambassador in Turkey or our Minister in Turkey must have had some conception of the German interest in the district and, I take it, informed our Government of it. Could you throw some light on that problem, Sir, because there seems to be here a tremendous separation between policy and strategy. If the Government had been aware of it and they had informed the naval leaders, it is possible there might have been a better outcome of that episode in the Mediterranean.

SIR EDWARD GRIGG: I am afraid I can throw very little light on it. I entirely agree with what you have said about the gap between policy and strategy. Our policy was not sufficiently clear on the importance of keeping German naval power away from Constantinople at the outset of the war and I do not know whether we had ever considered the problem.

ADMIRAL H. W. RICHMOND: When you say that the meaning of the freedom of the Straits is that no fortification should be erected and that thereby free passage would be got for merchantmen and men-of-war, I do not think that any fortifications are needed, because with the setting up of movable guns you could very soon stop merchantmen without any fortifications. Large movable guns could be put up there and so prevent the passage of ships.

SIR EDWARD GRIGG: I am afraid I was wrong in using the word "non-fortification". Our policy is demilitarisation with adequate force

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there to prevent troops ever moving into those areas. I am referring now to the areas we are holding at present and which the Turks have cleared out of.

LIEUT.-COL. FINDLAY: What about the other end—what about the Bosphorus? A similar thing will have to take place there.

SIR EDWARD GRIGG: Exactly the same.

LIEUT.-COL FINDLAY: It is very narrow—narrower than the Chanak end.

SIR EDWARD GRIGG: We would have to have the same arrangement there.

LIEUT.-COL. FINDLAY: You have not got that there now, have you?

SIR EDWARD GRIGG: Yes, we have got it on the Asiatic shore.

CHAIRMAN: Well, gentlemen, we have all listened with the greatest interest to the frank statement of the international errors of the last great war which Sir Edward Grigg has spoken about. They led, as he has pointed out, to diversions of troops just as there were diversions of troops when Wellington was in the Peninsula, and the consequence was that at the decisive point there were not enough men wherever we wanted them. The policy changed and the movements of troops changed.

Sir Edward has very carefully steered clear of the controversial side of this never-ending question. We soldiers are rather apt to jib sometimes, and I am sure he will realise, having been a soldier himself, the disastrous effect that changes have on us. You know the old wheeze "Orders, counter-orders and disorders", and we have got to realise that in the future we must try to steer clear of counter-orders. I think that when the last great war began we as a nation were more handicapped than any other big nation on the Continent. They had universal service and we had not, and I think I am right in saying that almost all their statesmen had in consequence some knowledge of military matters, at any rate in their early youth. That was not the case with us, and we all learned our lessons about the great value of policy and strategy working together in this war. In the future we have a smaller army, a smaller navy, and the air force might be bigger. But the officers and men in our fighting services are of exceptional material and it is necessary for the best output of our united effort that we must have some doctrine, some scheme, some continuous policy which will enable us to get the best out of the excellent material we have.

I have in conclusion to ask you to thank very heartily Sir Edward Grigg for the most lucid and clearly expressed lecture he has so kindly given us. (Loud and continued applause.)

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ARTILLERY, AND THE LESSONS WE HAVE LEARNT WITH REGARD TO IT IN THE LATE WAR.

BY COLONEL COMDT. L. C. L. OLDFIELD, C.B., C.M.G., D.S.O.

Wednesday, 15th February, 1922.

LIEUT.-GENERAL SIR J. F. N. BIRCH, K.C.M.G., C.B., in the Chair.

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THE CHAIRMAN: Ladies and Gentlemen, I do not think it is necessary to introduce Colonel-Commandant Oldfield to you, we all know what he did in France, and I will ask him to proceed at once with his Lecture.

LECTURE.

THE subject of this lecture is a very wide one and in the time permitted it is only possible to deal with a few of the many lessons learnt; others, equally important, can only be alluded to briefly.

The duties and scope of the Artillery increased as the war went on almost daily.

In fact it is not too much to say that when a weapon was developed or invented, the Artillery were at once asked either to help this weapon or to neutralise its effects.

When the enemy put out masses of wire, the Gunner was asked to cut it.

When his rifles and machine guns held up our Infantry in attack, the Gunner replied with a creeping barrage.

When the Higher Command decided to use gas the Gunner was asked to fire it in especially designed shells.

When Tanks were used in the attack the Gunner had to fire smoke as a screen, and, again, to knock out hostile tanks.

It is, I think, interesting to see how the official book describes the characteristics and duties of Artillery in 1914 and 1921.

Briefly, in 1914, Artillery duties were described as follows :—

> "Till the enemy discloses his dispositions Artillery must usually limit its action to preparing to support the other arms as soon as occasion demands it."
>
> "Rapid fire cannot be maintained for more than brief periods without exhausting ammunition."
>
> "The duty of Artillery is to assist the Infantry to establish superiority of fire over the enemy."
>
> "Heavy Artillery is chiefly used with enfilade or converging fire, particularly on buildings and the enemy's guns."

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"Siege Artillery may be allotted to the field Army for special duties in connection with Fortress operations."

In 1921 the official book talks of barrages, gas shell, anti-aircraft guns, anti-tank guns, harassing fire, smoke shell, close support of Infantry guns, wire-cutting, co-operation with aeroplanes, counter-battery work, and emphasises the importance of medium, heavy and super-heavy guns and howitzers.

Artillery generally is described as being able to develop an overwhelming bombardment without previous warning, and to engage targets by day and night without observation and yet with accuracy.

Evidently there has been a great proportionate increase in the scope of the arm, but its primary *role* remains the same as it was in the days of Napoleon, namely, to assist the other arms in breaking down opposition and to afford all possible support to the Infantry with whom the eventual decision rests.

The train of thought expressed by some other nations that "the Artillery conquers, the Infantry consolidates," has of course no meaning in the British Army of to-day.

It may, I think, be assumed that a future war between Great Powers will begin with a period of open warfare, intense and short, and, failing a decision, a period of position warfare will ensue. This will last until one side, by increased numbers, skill, new or improved weapons, becomes strong enough again to compel the adversary to fight in the open.

With the present state of finances, no nation is prepared to spend large sums on new equipment. A war of the next few years would probably begin with very much the same weapons as were in vogue in November, 1918.

Still, it should be remembered that, just as the highwayman is more ready for a fight than the honest citizen, so the nation that desires war will generally have the lead in weapons and training.

But from the moment of the outbreak of war, the whole scientific and industrial strengths of nations will begin working at high pressure.

Tanks, aeroplanes, and other expensive implements of war will appear quickly in great numbers, though probably not before either a decision has been reached or position warfare has set in.

We have, therefore, to consider to-day not only Artillery as it would function at the beginning of war, but its duties after a few months of war.

And so perhaps the first lesson the gunner has learnt is to make himself ready to learn new lessons and adapt himself, when the time comes, for new machines and weapons and new tactics.

How many lives might have been saved if it could have been foreseen that an Army in defence would put out barbed wire quickly and that the Artillery would be asked to cut it?

Surely the next war will see great developments in machine guns, tanks, wireless telegraphy, etc., and the Artillery must be prepared to co-operate with our Army in every kind of way and to neutralise improvements of the enemy.

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In the late war the long static period gave us time to think, learn, and invent.

In the next war we may not be so fortunate.

Training of Personnel.

It is necessary, I think, for us all to remember that the British Army exists for all kinds of wars—not only great European wars against enemies of the first class in equipment and training—and that our training must be such as to fit us for many different kinds of fighting.

Above all it is necessary to get out of our heads the idea that we are likely to spend long years of static warfare and to prepare for that mainly. In fact our training should be such as to prevent static or position warfare.

If it does set in we must try and break it down.

Only manœuvre and movement can achieve decision, says Marshal Foch.

And the war of the future must be visualised always as a moving warfare.

Tactical exercises and practice camps have shown me how deeply rooted in our minds has the idea become that quickness of decision and action are no longer essential.

Commanding officers responsible for training will find only too many opportunities for rubbing in the necessity for an Army being even more mobile than it was in 1914.

Evidently much more is being demanded from the Artillery officer of to-day than before, and still more will be wanted in the future.

It is not enough for even a junior officer to know one gun and its equipment and ammunition thoroughly. He must not be a specialist in one branch of the arm. He must receive a sound general training not only in his own armament, but in others, and especially in Infantry work, so that he may be ready to take advantage of any changes in weapons or tactics which the future may bring forth.

These changes come slowly in peace time, but rapidly when war has started and economy no longer limits experiments and training.

The aim should be to make the young R.A. officer no longer think of himself as only one of a team whose main object is to create a good battery, but also as ready to assist in any way to help his side to break down the resistance of the enemy.

Indeed, much more attention must be paid to instruction of Battery officers in Artillery tactics. It is not sufficient to be able to hit the target. He must be on hand to hit the target at the right moment, sometimes on his own initiative, sometimes at the request of the Infantry or Aircraft.

It is even more important that senior Artillery officers should be able to think in terms of all natures of Artillery.

At the beginning of the Great War, for various reasons, officers of the Field Artillery had little knowledge of the possibilities and limitations of what was called Garrison Artillery, and *vice versa*.

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A recent Committee was of opinion that the two branches of the Royal Regiment should be re-united.

If this re-union is not to take place it is at all events necessary that steps should be taken to ensure that senior officers of the Regiment are kept well up-to-date with the latest developments of guns and howitzers of all natures and be able to handle them in war. I think this is a lesson which has not received the attention it deserves.

Much more responsible work, too, must be expected of the non-commissioned officer.

He must be taught to rely on himself and expected to observe fire, re-sect positions, lay out lines of fire, and do many of the duties which a subaltern generally does.

This is already done in Foreign Armies, and will help to solve the eternal problem of shortage of trained officers.

If this is done in annual practice camps and tactical exercises as a matter of course, non-commissioned officers will soon learn to interest themselves in their more extended duties and get increased confidence in themselves.

Artillery in Attack.

Pre-war ideas contemplated an artillery duel, after which the winning artillery would concentrate its fire on the enemy's infantry and prepare a way for the attack.

Concealment of guns and map-shooting without previous registration have modified the artillery duel.

Infantry while advancing cannot develop sufficient fire-power to overcome the greatly increased defensive power of rifles and machine guns.

We thus learnt early in the war that Infantry cannot advance by daylight above ground against defenders who are properly arranged in depth, unless it has mechanical help from other arms. Generally this help is provided by Artillery or Tanks.

It is necessary to call attention to the great difference in the support which the artillery can provide if time is available to make preparation and bring up ammunition.

In such case the Artillery support may be briefly described as follows :—

(*a*) Most of the heavy and medium howitzers and a proportion of field guns and howitzers try with H.E. shell and gas to neutralise the enemy's guns.

(*b*) A small proportion of field guns advance in close touch with the attacking Infantry. These guns do not take part in the barrage as it is essential that they should be mobile and all ranks fresh when the time comes.

(*c*) The remainder take part in the barrage.

In the German Army this took the form of heavy concentrations of fire from howitzers, field guns and mortars, on different chosen localities, the fire lifting on to a new area according to a time-table. This worked well with specially trained troops when time had been allowed for careful reconnaissance of the position to be attacked. It

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is, however, less suitable for open warfare when these conditions cannot be carried out. Also the attacking Infantry cannot keep as close to the barrage as in the case of a British or French continuous line barrage.

A British barrage extends in depth into the hostile defence line far enough to smother machine guns and rifle-aimed fire, say 1,500 yards. This belt of fire advances in front of the Infantry at a prescribed rate, which becomes gradually slower as the attackers advance, and pauses on certain lines, the whole moving according to a fixed time-table, which is indicated to the Infantry by a barrage map.

A well arranged barrage of this type with almost unlimited ammunition was one of the causes of the successful attack on the strong position of Beaumont Hamel in November, 1916. It showed great advance on the thin artillery support that was possible at Neuve Chapelle in March, 1915.

An effective barrage of this kind can only be provided for a frontage of 1,200 yards with the guns at present arranged for a Division.

In view of the frontage of a Division being generally much more than this, the deficiency in guns must be remedied in some way, either—

1. By more guns being made available, or
2. By the guns shooting at a greater rate, or
3. The use of Tanks may make a thinner barrage effective, or
4. By using an effective barrage on certain localities only and taking the intervals by turning movements.

It is likely that this last is a possible solution, provided that the Infantry are highly trained.

Increasing the rate of fire, except for very short periods, is liable to exhaust the gun detachments and lower the accuracy of fire.

It should be remembered that an unnecessarily intense barrage means (for the same number of guns available) a narrower front to attack.

Also a greater rate of fire (for the same amount of ammunition) means less depth of attack.

These are points which the Higher Command must weigh very carefully. Certainly the broader the front attacked the greater the chance of success.

No penetration can be decisive unless it reaches the enemy's gun line in the first rush of the attack.

In fact the barrage is a good servant but a bad master, and must be made to conform to the plans of the Commander.

It should be noted that the guns of the attackers must have at least as great a range as the guns of the defenders which will be aranged in depth. If they have not, the Infantry will not have the barrage to help them as far as the defenders' gun lines.

At the present time the British field gun has not got this necessary range.

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If the barrage guns cannot reach the enemy's gun line the only alternative is to advance the guns during the barrage, but not more than half the number being on the move at the same time.

This means that there must be longer pauses or that the barrage will be thin at times while the guns are moving. Re-secting new positions and making new barrage tables involve still further delay.

What I have been describing applies only to a grand attack, when there has been plenty of time for preparation and an ample supply of ammunition.

In moving warfare or where small forces are engaged Artillery support will generally take the form of concentrations on localities for short periods of time.

Or a simple form of barrage can be extemporised in a few hours if gun positions can be accurately re-sected and good maps are available.

But it should be remembered, and especially so by the Infantry, that a brigade of Light Artillery can only provide an effective barrage over about 400 yards, and that the amount of ammunition available in the Division will only allow each gun to fire for one hour continuously.

I think the expression "barrage fire" should not be used for a less number of guns than that in a brigade of Light Artillery.

After General Byng's attack at Cambrai, in November, 1917, all attacks tried to introduce the element of surprise, and it is certain that when tanks are used this will always be attempted in future. It will also be tried in moving warfare or when the wire in the defenders' position is not so thick as to require several days' bombardment.

It is probable, however, that, in some way or other, the defender will know an attack is imminent, though the exact moment of zero will be uncertain.

The mobile guns accompanying the Infantry have an extremely difficult task. Their very presence has the greatest moral value, both for their Infantry, and conversely for the enemy's.

They will generally be used as sections or even single guns. These guns should ordinarily not be used for tasks which machine guns could do equally well. A machine gun is easier to conceal and quicker to bring into action.

The proper target for a gun is one which is beyond the power of a machine gun, such as a house, a fortified strong point, a shielded gun or a tank.

In open country it will be hardly possible for them to move in daylight within rifle fire of the enemy and this means great difficulty in communication with subordinate Infantry commanders.

It is in close country fighting, however. that these forward guns will be most wanted.

In such circumstances guns can often be brought up to within a few hundred yards of an enemy's strong point and will not be discovered until they open fire. In some cases Pack Artillery would be more suited for this kind of work than field Artillery, especially

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the Pack Howitzer with its high trajectory.

This very close support can be afforded much more frequently and successfully than is generally believed, but needs great skill in reconnaissance.

Another difficulty is that at short ranges guns cannot shoot over the heads of our Infantry unless the ground is very favourable.

In many cases it is the only possible method, as, apart from the communication difficulty, the guns placed at greater range would not clear intervening woods, hedges, houses, etc.

Forward guns of this type will nearly always fire by a pre-arranged time-table, arranged directly by the Gunner officer with the Infantry unit commander.

As the unexpected machine gun is one of the chief obstacles to advancing Infantry, even when working behind a barrage, it is imporant that this close Artillery support be thoroughly understood and practised together by junior officers of the two arms.

Certainly it should be a regular feature in both field days and tactical exercises without troops, on the same lines as co-operation between Infantry and Tanks.

Probably improvements in wireless telegraphy or telephony will solve the communication difficulty and the adoption of Field guns on some form of Tank tractor will make the difficulties of advancing under rifle fire easier to surmount. But on both these points I shall have something to say later.

A Gunner is often asked as to what time suits him best for the start of an attack. The answer is that, though daylight is less tiring, he can with modern appliances shoot equally well at all hours. As the guns of the attack are shooting from a time-table and by map-shooting his fire cannot be corrected by observation in the earlier stages.

At the same time there is a limit to the endurance of the Gunner in action, and in the Great War, and especially at Ypres salient in the autumn of 1917, he was often set too great a task.

It may be taken as a fact that a barrage in which each 18-pdr. gun fires 500 rounds is about as much as he can undertake without a loss of accuracy in fire, and the same applies proportionately to other natures of Artillery.

Artillery in Defence.

A force in defence has necessarily for the time being given up the initiative, at all events locally. It is this that makes the task of the Artilleryman so difficult.

He is not making out a plan to work with the Infantry in a pre-arranged attack at a chosen time, but has to stand ready to help repel an attack at any time; and this attack may be delivered in many diffierent ways.

I cannot do better than quote four different cases where guns were used with decisive effect on an attacking enemy.

First, the classical case on 15th July in Champagne when General Gourand got from German prisoners the exact time, place, and scope of the forthcoming German attack. In this case the

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French Higher Command withdrew its troops in the forward zone at the last moment. The German Artillery spent its ammunition on empty trenches and when their Infantry advanced they were overwhelmed by French Artillery firing by a pre-arranged plan. This was the last great German attack which ended in confusion and heavy losses in material and *morale*.

Next I will quote the case of a small German counter-attack made by three weak companies against the 61st Division in April, 1918, just east of Robecq. It seemed certain that the Germans would try to retake a small ridge near Pacaut. The C.R.A. arranged for three bursts of harassing fire to take place at likely times for a counter-attack. One of these bursts of fire was timed for an hour before dawn, and took the form of a creeping barrage over an area of 1,000 yards square just in the enemy's lines. As it happened this barrage just missed the leading company, but practically destroyed the other two companies. The leading company advanced in a hesitating manner and practically surrendered *en bloc*. No further attack was attempted, the British casualties were nil.

The third case I will quote was at the Third Battle of Ypres. On the afternoon of the 23rd September the Germans, in greatly superior numbers, counter-attacked from Poelcapelle on to a British defensive flank. This counter-attack was in full view from the British observation stations. The whole attack was broken up and the German Infantry never got within assaulting distance of the defenders' lines.

The fourth case I shall quote was an incident in the Cambrai battle of 20th November, 1917. The attack of the 51st Division was held up at Flesquières by the indomitable courage of one German Artillery officer who, at close range, with his field gun firing direct, knocked out tank after tank as it advanced to make a road through the barbed wire. His gun was just behind a ridge, and so invisible to the British Artillery.

Now these four cases provide us with four chief lessons to be learnt as regards Artillery in defence.

Artillery must be capable of producing annihilating concentrations of accurate fire when ordered by the Higher Command.

Guns must be arranged in depth and even the most subordinate commander must be ready to use his initiative in the most unexpected situations.

Observation must be obtained and communications established at all costs and every opportunity taken of bringing the enemy's advance to a standstill.

The attacking Infantry are advancing at a pre-arranged pace, and if they can be so delayed as to lose their protective barrage they have little chance against the Infantry and machine guns of the defence.

Harassing fire must be carefully arranged by the General Staff so as to inflict casualties and break up concentrations. Every bit of information and probable action of the enemy is to be considered and no round fired without careful forethought.

The arrangement of putting down a protective barrage just in

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front of a defending Infantry after the attack has commenced finds few supporters now. It is the duty of the Infantry to deal with the first elements of the attackers. The duty of the Artillery is by counter-preparation and counter-offensive to inflict casualties on the enemy, to break up concentrations, and to isolate the first waves of the attack.

The defence, like the attack, must keep a certain number of guns and howitzers, heavy and light, mobile to deal with fresh situations.

Field Service Regulations lay down that Artillery and machine guns are the backbone of the defence. There are always certain areas that are dead ground as far as machine guns are concerned. On the other hand, guns can be sighted so as to shoot almost anywhere. It therefore follows that defensive fire of guns and machine guns must be carefully co-ordinated.

It is also essential that a Senior Artillery officer should be consulted before taking up a position of defence. The German gunner evidently had a lot to do with the siteing of the Hindenburg Line, which gave him safe observation and good fields of fire while denying the same to our Artillery.

Let us consider what a difference it would have made to us if we had appreciated this lesson in November, 1914. Surely experienced Artillerymen would have been consulted and the line adjusted so as to give us all possible advantages not only for defence but for offence when the time came.

I am speaking of course purely from the Military point of view. Political considerations might compel a different line of conduct.

Artillery officers must be practised in reconnoitring country with this object in view, so that when asked for an opinion they can give reliable advice. It should certainly be one of the features of Command and Divisional Tactical Exercises without troops.

Artillery fire must be very flexible. In defence command must be more decentralised and yet the Commander must be able at any moment to resume direct command.

Constant reconnaissance must be going on and a ready response made to any calls from the Infantry or from Aircraft.

The defence should try to provide surprises for the enemy and not leave all the initiative to the attackers.

The late war gave many instances where the guns of the defenders became invaluable rallying points to Infantry who had been severely handled.

A well-known case was specially singled out for description in Lord Haig's despatch :—

This was the case where two R.F.A. Officers held the crossings over the La Bassée canal near Hinges for six critical hours on 12th April, 1918.

I have made little mention of counter-battery work in attack or defence, as it is better dealt with under a seperate heading, and this applies also to gas and smoke.

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Counter-Battery Work.

The Artillery duel has taken another form now that batteries fire from concealed positions, and in many cases are kept silent till wanted for serious operations.

As before, the object is to neutralise all hostile batteries which can fire on the Infantry and prevent their movements.

In moving warfare, or where small forces are engaged, the Artillery commander of the force makes use of the guns at his disposal. But with larger forces, or when the fighting has assumed a static character, even for a few days, a regular system of counter-battery work comes into play.

Each Corps has a Counter-Battery Staff Officer whose duty it is to locate the enemy's guns by every means at his disposal and prevent their firing either by :—

1. Destructive shoots with ground or air observation or by means of sound ranging.
2. Concentrations of fire by map-shooting.
3. Neutralising by gas shell, etc.
4. Organised harassing fire, which affects their supply of ammunition and supplies.

Any or all of these methods may be used successfully, but they all require a very free use of ammunition.

For instance, under the most favourable circumstances it is calculated that a 6-inch howitzer would require about 500 rounds to knock out a hostile battery by direct hits with destructive fire, and the other methods are even more extravagant in ammunition.

In static warfare it may be taken that almost every active hostile battery will be located so long as it remains in one position..

Besides flash spotting, ground and air observation, the Counter Battery Staff Officer has new methods of locating guns.

The two most important ones are air photography and sound ranging.

On an air photo a trained eye can locate almost every battery as it is, even with the freest use of camouflage, almost impossible to hide tracks made by bringing up supplies and ammunition unless the gun position is actually on the edge of a road. Of course such a site for a battery is very undesirable for other reasons.

To the pre-war Gunner sound ranging seems almost miraculous. A sound ranging section can locate a hostile battery to within 50 yards and give the position of the shell burst and the calibre of the gun. It can then range a battery successfully on to the hostile battery and correct its fire—all this of course only when conditions are favourable, but it shows the immense possibilities of the new invention.

During a moving fight ground observation is the best of all methods, but if I may be allowed to prophesy, I think that most counter-battery fire will take the form of concentrations fired in answer to calls from aircraft. Every Field Artillery brigade and Heavy or Medium battery has its own wireless set, which should be always on the alert to answer such calls.

Indeed, our French friends believe that the days of pinpoint firing are over and that it is in concentrations that Artillery of the

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future will be chiefly engaged. This may be the case, but I hope it will always be part of the creed of a Gunner that unobserved and uncorrected fire is only permissible when there is no alternative.

Gas and Smoke Shell.

The advisability of using gas shell seems to be still a matter for consideration in the minds of statesmen. For us as soldiers the obvious duty is to prepare for its use when and if we are allowed to use it.

Evidently its use against uncivilised or even badly equipped enemies might in some circumstances be decisive.

The best known instance of the use of gas shell on a large scale was in September, 1917, when Von Hutier completely overwhelmed the Russian positions, thanks to surprise and the intensive use of gas shell.

Gas shell contains many kinds of poisonous fluids, which may be roughly grouped into two classes.

First, persistent gas, which lingers for a long time when weather conditions are favourable; and secondly, non-persistent gas, which soon disappears.

It should, however, be clearly realised that gases have many and varying characteristics other than their relative persistence; "penetration" is one of these, *i.e.*, I mean by penetration the power of gas to penetrate an enemy's gas mask.

"Penetration" is, of course, a variable power, depending on the continuous struggle between new gases and new respirators.

Gas is a new weapon, with almost unlimited possibilities against combatants and non-combatants alike. Persistent gas shell should never be fired in the attack without reference to the General Staff or to the Infantry commander concerned. With this exception, gas shell will be used like other shell—that is, at the discretion of the Higher Artillery Commander.

Gas clouds can be produced by all natures of guns and howitzers suddenly opening concentrated fire at a quick rate.

Splinter proof cover, including buildings of all sorts, presents very unfavourable targets for attack by gas shell, which may for this reason have their decided part in future moving warfare.

The effective use of gas shell depends on :—

(*a*) Suitable meteorological conditions, together with a knowledge as to how best to turn those conditions to account.

(*b*) Appreciation of the properties of the various gas shell at disposal.

Limitations of transport under moving warfare conditions demand that the proportions of shrapnel, H.E., gas and smoke shell shall be carefully determined before movement takes place.

In static warfare it has a most demoralising effect on all ranks. The nation which wants a war will probably first make certain of a plentiful supply of some especially poisonous gas, which will give it a great advantage.

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It must be remembered that gas is the cheapest engine of destruction we know of.

It is certain that all the leading nations are busy experimenting at the present time and that gas is already a far more serious factor than it was in 1918.

The outbreak of war between the leading nations will probably be heralded by tremendous gas attacks, which may have most serious consequences on *personnel* and *morale*.

Smoke.

Smoke is a weapon for attack, to conceal movements of troops and especially of tanks. It gives some of the advantages without the disadvantages of a night attack. It will probably be used largely in future in the attack. A defending force will, generally speaking, do nothing which would decrease its power of observation.

Map-Shooting.

One of the most important developments during the war is in the direction of Predicted or Map-Shooting. Though no Gunner worthy of the name will ever neglect an opportunity of observing and correcting his fire by some means or other, the fact remains that a very high proportion of his fire will be unobserved and its accuracy will depend on the care and skill which have been exercised before opening fire.

In the words of the Field Service Regulations, the Artillery is able under certain conditions to develop an overwhelming bombardment without previous warning, and to engage targets by day or night without observation and yet with accuracy.

All barrage fire in attack, all gas and smoke shell fire, all night and dawn firing and most of the harassing fire depend on skill in map-shooting.

Even when observation is possible it is equally important to try and put the first burst of shell-fire near the target, as this is the only chance of catching the enemy unprepared.

During the process of ranging a good target, men will naturally disperse and get under cover.

This is a point which the old-fashioned Gunner, for some reason, is apt to overlook.

It is worth while considering briefly the "certain conditions" I have given. They are as follows :—

1. The guns must be calibrated, that is, their muzzle velocity must be known under normal conditions. This is fully recognised, and every gun is marked with its muzzle velocity and the date on which it was last determined.
2. The meteorological conditions of the moment. This is met by sending out messages from Meteor six times in every 24 hours. In the last war these messages were sent by telephone wires. In the next they will almost certainly be sent by wireless.
3. The ammunition must be constant or grouped, according to weight. I will refer to this again later.

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If the above conditions are carried out a well drilled battery can shoot down to within the error of the gun, *e.g.*, an 18-pr. at 4,000 yards would drop all its shell within 80 yards of the target, *provided the maps are accurate* and give sufficient detail.

But the last condition is very difficult to secure, a fact which we are led to overlook because of the extreme accuracy of our maps in the theatre of war on the Western Front.

For accurate map-shooting the scale of the map must not be smaller than $\frac{1}{30000}$th, say, 2 inches to the mile, and the levels must be contoured accurately to within 40 feet.

It is a fact that at this moment no such maps exist, except for the British Isles and some recent theatres of war.

If, therefore, our Artillery were asked to do accurate map-shooting or fire a barrage in a country such as the Balkan States they could only do so within the limits of accuracy provided by the maps.

Probably science will solve this, too, for us, if time and resources permit. Even now our Survey Department can map country from aeroplane photographs and print maps accurately in a few hours.

There are indications, too, that it may even be possible to obtain the levels of country so photographed, and it is of great importance that this great difficulty be successfully negotiated.

What is called "Survey Work" has become part of the duties of the Artillery officer. Not less than one officer per battery must be proficient in this, and all officers must have a good working knowledge of the latest methods of laying out lines of fire by day and night.

Communications and Observations.

These in future will nearly always be by telephone, wireless, or orderly. And it is of the greatest importance to develop wireless. The present C.W.W. is heavy, and its messages are liable to jamming. But even if it does take three men to carry one set, this is nothing to the number of men required to keep a line in working order.

In the smoke, gas and confusion of the modern battlefield I am afraid the flag and lamp will be of little value even in a moving battle. Till the wireless problem is solved recourse must be had sometimes to coloured lights to call on the Artillery for fire from the front line, though this method is both prehistoric and unsatisfactory.

It is of primary importance that Infantry officers should see that these signals are only sent on the right occasions. A wrong signal may mean a sleepness night for many tired men and wrong expenditure of tons of valuable ammunition, all of which has to be brought up under fire.

The most vital communication of all is *liaison* between officers of the different arms, and, however great the shortage of Artillery officers, this *liaison* should not be stinted.

It is difficult to overestimate the importance of communications in war, and as experiments in wireless communication are relatively inexpensive it is reasonable to hope that great strides will be made in the next year or two in both wireless telegraphy and wireless tele-

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phony. Most Artillery officers would prefer money and energy to be spent on this to almost any other expenditure.

I hope that what I have said as to the possibilities of map-shooting will not have given the impression that observation has become less important, for nothing is further from my thoughts.

It is true that much of our observation will come from the air, but, whenever at all possible, ground observation is the best, it being always remembered that observation without prompt and reliable means of communication is of little value.

Further, observation is not the duty only of the Artillery. Our resources are limited, and we must have the help of observers of other arms, who must be able to communicate with the guns.

I think I would call this one of the imporant Artillery lessons of the war.

Supply and Material.

A few remarks on supply and material will be of interest.

The number of types of guns and howitzers must be reduced as far as possible, not only to facilitate manufacture in quantity, but to simplify supply in the field.

The minimum range should be 10,000 metres.

As many field guns as possible should have the new split trail with wide traverse to knock out tanks.

Certainly the flank guns of field batteries should be equipped with this trail at once.

The different patterns of weights of shells, fuzes and explosives must be reduced to one standard type for each nature of shell; otherwise quick and accurate map-shooting will be impossible.

Arrangements must be made in peace time with industrial concerns so that suitable plant is ready to enable them to turn on to munition-making without delay. Some idea of the expenditure of ammunition in the war may be realised when I say that the Fourth Army fired 3,700 waggon loads of 18-pdr. ammunition alone on the one day of 8th August, 1918.

As regards guns and howitzers heavier than Field Artillery.

We began the war with 500 pieces of Artillery, all being field guns and howitzers, except 24 60-pdrs. We ended with 6,500 pieces of Artillery, of which two-thirds only were field guns and howitzers.

This high proportion of the heavier natures was due no doubt to the long period of position warfare. In the next big Continential war a new proportion will have to be fixed. But it is certain that the Expeditionary Force will have at least one-quarter of its guns and howitzers of medium and heavy types.

Mechanical Transport of Artillery.

I must say a few words about Mechanical Transport of Artillery, for, whether we like it or not, it is bound to come, though not so soon as some enthusiasts think and hope.

In 1918 the French reinforcing batteries of 75's were tractor drawn and tractor carried. A lorry carried one gun complete and drew another.

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These "Porte" batteries could cover 100 kilos in a day and bring the detachments quite fresh into action with 200 rounds of ammunition per gun. . The chief drawback was that they had to keep to the roads and occupy positions along the sides of roads.

At the end of the war the American Artillery was approaching what they called motorisation as quickly as possible.

At present the calibre and weight of the field gun is decided by the limit that a six-horse team can pull. With mechanical transport the whole question of calibre can be reviewed afresh.

Besides expense the only limit appears to be the strengths of the road, bridges, and the number of vehicles to carry the ammunition and spare parts. After initial expense, mechanical transport is cheaper and requires fewer personnel. Tanks do not require constant grooming and exercising.

I might hazard a guess and say that at the end of the next war the rapid moving artillery, working with the Cavalry or Tanks, or in close support of the Infantry, will be field guns on armoured tanks and capable of firing off the tanks.

All other guns for barrage, etc., will be drawn into action unlimbered.

There are, of course, many difficulties to be got over first. Amongst others, reconnaissance, supply of petrol, etc.; but science will solve these problems too, very rapidly when the necessity is clear and expense no longer thought of.

All nations are experimenting. Our first M.T. Field Brigade, R.F.A., has just come into existence.

The French inventors are already busy. The French Higher Command think that the difficulty of hiding artillery horse lines is so serious as to compel this change to mechanical transport, even if there were not other advantages.

The increased scope of Artillery has necessitated a great increase in expenditure of ammunition. This is a big problem even in position warfare, where dumps can be formed and light railways laid.

But we have learnt that there is a great expenditure in moving warfare also. In this case the problem can only be solved by mechanical transport. Probably an almost unlimited supply of lorries, similar to the present 3-ton lorry, will be easily acquired in an industrial community; but such lorries do not fulfil all requirements.

Some at all events of the lorries must be able to go across country right up to the gun positions.

Conclusion.

The most important lesson of all is a very old one, but one which in the Great War was driven home to us all. And that is Artillery must be used in closest *liaison* with the other arms.

Though its *rôle* has become a greater one under modern conditions, the best can only be got out of it when it thoroughly understands and is understood by the other arms. There is no mystery about the tactical employment of Artillery, and other arms must know its powers and limitations.

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From the nature of the subject of this Lecture I have been forced to talk much about machines and implements of war and so I will conclude by quoting the words of the greatest Gunner of the present day, Marshal Foch :—

"Success will only be achieved by movement and manœuvre. The fighting of the future will be sometimes on positions, sometimes between positions, and sometimes purely in the open. The organisation of armies and their fighting methods will develop as machinery and material improves, but the principles will remain unchanged. *Morale* will always remain in war the supreme argument. The sound moral education of the soldier will always remain the chief factor of success and victory."

Discussion.

Brig.-General H. de T. Phillips : Mr. Chairman, Ladies and Gentlemen, the Lecturer, as he told us, had to omit many points owing to being much pressed for time. There was one point in which, I think, everybody is much interested at present He talked of the great importance of aircraft in warfare, and I suppose every soldier has, at times, at the bottom of his heart, cursed the introduction of aircraft, from the point of view that operations involving secrecy or surprise must be conducted at night, which means much discomfort to all concerned.

We have all known in past years of the struggle of "guns *versus* armour," which has almost become a proverbial expression applicable to the principle that the latest development of one method or means must be countered by the developement of something to oppose it.

Aircraft have undoubtedly done more to revolutionise warfare than any other previous invention, and the great desideratum of the moment appears to me to be the concentration on some method or means that will nullify or minimise the influence of aircraft, whether in their *rôle* of observation or bombing or the possibility, of which we have read much in the papers but taken little notice of, of large numbers of aircraft, in flocks, transporting large numbers of men and dumping them down behind the enemy's lines. Well, I think a target of that nature could be easily dealt with by our existing guns of all natures and, in any case, the dumped force has either to maintain itself there or get away again, a matter of some difficulty.

In the late war even single aircraft were sometimes brought down from great heights by a single anti-aircraft gun. A flock about to alight ought to be easy to "brown." But we want something more to make it unpleasant for aircraft at all times. We want, to begin with, a weapon of very high muzzle velocity, and we must make a study of the different ballistics involved when shooting at very high angles of elevation. Our old assumption of the "fixed trajectory" is no good. The first thing, the high velocity gun, appears to have been already invented in America, by John Temple, and in some other country. Having got the gun we should concentrate on ballistics and devise a possible method of minimising the action of aircraft.

Another new devolopment which has been successful is the tank, but how to find a certain method of destroying tanks I do not know.

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Yet, so far as we have been predominant in that line, our possible enemies are probably busy studying methods of countering tanks.

Again, the lecturer mentioned trench warfare, and the preference expressed by all soldiers, at any rate in our own army, for the conditions of moving warfare. There is, however, one point in this connection to consider. In the late war, other nations learnt the possibility of the British raising a far bigger army than they imagined. In that respect our cards are now on the table. We raised and trained that army, without at once resorting to compulsory service, during the war.

I may be wrong, but I do not think we should have been able to wait for that army or train it nearly as efficiently had it not been for the period of trench warfare, which in this respect was a Godsend for us. Trench warfare has many objections, but I think other nations will grasp the fact that it enabled us to train a large army. As long as we only maintain a very small army and have no compulsory service, other nations will not want to give us an opportunity of improvising a similar army. It would, therefore, be in the interests of any enemy with a larger army to try and force an early decision by great pressure during the initial period of open warfare.

The lecturer also touches on the question of the re-amalgamation of the branches of the Artillery. He said he believed it was the opinion of the higher Staff of our army that it was desirable, and I think that nearly every gunner with whom one has discussed the matter is of the same opinion. He pointed out that heavy artillery will in future form a quarter of the artillery strength of any expeditionary Force. This being so, surely makes the amalgamation of greater importance than ever before. The recognition of the value of heavy artillery grew, but grew slowly, after the South African War. One of the few lessons of the last Balkan War was the undoubted value of heavy artillery in battle. The Germans seem to have grasped the lesson, and took the field with a comparatively large strength of heavy guns, with the result that we started with a distinct disadvantage. As we shall probably start the next war with an increased proportion of heavies, I think an immediate amalgamation of the Artillery would bring about that perfect *liaison* within the Artillery which the Lecturer so rightly insisted on as being essential between Artillery and the other arms. I think that is all I want to say.

Major-General W. H. Anderson (Staff College): Mr. Chairman, Ladies and Gentlemen, I am afraid I am called upon under circumstances which make it very hard to produce anything, but I have been rather pointed to as the Infantry soldier in the midst of the wolves of the Artillery. I should like to get on to a point affecting the Infantry now very closely indeed. It is a question whether the forward sections of artillery are near enough to the battalion commander of the Infantry who is responsible for some 800 men, and who may possibly be attacked by tanks when not immediately supported by artillery with whom he is in communication, and who may wish at once to have moral and material support for his own men. Does it not mean getting back to the battalion gun? Can that gun be

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manned by our Infantry? Is it sufficiently simple, or does it require Artillery personnel, that is, to give immediate support, not to a brigade commander of Infantry, but to a battalion commander of Infantry?

MAJOR-GENERAL G. D. JEFFREYS, C.B., C.M.G., (London District): Lord Horne, General Birch, and Gentlemen, I feel like General Anderson that I am among a distinguished company of gunners, and that a mere Infantryman is almost guilty of presumption in venturing to say anything; but as General Birch has called upon me, I feel it incumbent on me to get on my legs. I should like to say how heartily I and every Infantry soldier will agree with the Lecturer in emphasising the necessity for greater *liaison* between Artillery officers and Infantry officers in the field. I believe, if I may venture to say so, that it was the greatest want in our pre-war training of any as regards mutual co-operation between the two arms. I do not think the average Infantry officer at the beginning of the war really knew anything of the methods and the tactics of the Artillery, and I think I might also say that the average Artillery officer knew almost as little of the tactics and the methods of the Infantry in the front line. I hope I am not libelling the Artillery in saying that. I think also (it is rather getting off the rails) that in our training in the future it will be a great thing if we remember that as we go on there is a tendency to create new arms and new branches of the Service which live in water-tight compartments and which are totally ignorant of the methods and the tactics and the ideas of the other branches. To my mind it was not only not a retrograde step, but very much the reverse, when the independent existence of the Machine Gun Corps was brought to an end, because if machine gun officers are not practical Infantry officers, in touch with Infantry thought and tactics, they are worth very little—the same applies, *mutatis mutandis*, to the relations between the Artillery and the Infantry. If they are not in the closest touch, if the Artillery officer does not understand Infantry tactics and ideas, and conversely if the Infantry officer is not in touch with Artillery methods of working and tactics, we shall never get the full co-operation in the field which we all know and all admit to be so essential. This is all I will venture to say on the subject.

GENERAL LORD HORNE: General Birch, Ladies and Gentlemen, it had not been my intention to join in the discussion to-day, because I have on three quite recent occasions given expression to my views in this building. Leaving all technical subjects on one side, which no doubt will be commented upon by our Chairman, I think there are one or two points that come into prominence from this lecture. The first is the importance of research and experiment. We read of the necessity for economy and we all admit that necessity, but I note with very great regret suggestions that our schools of research and experiment should be cut down. Now, however small our Army may ultimately be, surely it ought to move with the times, and if it is small, it should be the very best equipped both in material and in scientific knowledge. The second point is a matter which I hope it is not wrong to refer to in connection with this lecture. This lecture must have impressed on those of us present that artillery and similar appliances for the assistance of the infantry have during the past

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few years assumed much greater importance than they ever had before. It is not reasonable to think that that importance will increase as time goes on? Yet the shadow of the Geddes report is hanging over us. That report suggests that, because our auxiliary Arms are better equipped and are more scientific, therefore they should be cut down. The suggestion that because we have advanced in weapons and appliances, for that reason our Army should be reduced, runs through the Geddes Report. Are other nations, other possible enemies, not making equal advance in weapons and appliances If we had carried out the principles of the Geddes Report, we should still be as in the days of the bows and arrows of Hastings or the men in armour of Poitiers or the muzzle-loader of the Crimea. I cannot follow the argument that because we are better equipped, that therefore we can do with less. Are our possible Opponents going to follow that line? I think that all those of us who have had practical experience of war should, as far as we can, point out the fallacy and the futility, may I say, of arguing on such lines as that. Perhaps I have gone rather beyond the bounds of what I should say at this lecture, but still as I listened to Colonel Oldfield I could not help feeling that those who heard him to-day must have realised the importance of the auxiliary Arms and the importance of ensuring that they are maintained at their highest state of efficiency.

Colonel Oldfield: Ladies and Gentlemen, with regard to the question of Anti-Tank defence referred to by General Anderson, I had something to say which got rather crowded out for lack for time.

Officers in the Tank Corps contemplate three different types of tank. First, the fast independent tank, which has hardly as yet come into existence; secondly, the transport tank; and, thirdly, the slow moving 5-miles an hour tank which moves with the Infantry and may be taken as a form of Infantry—in fact, as armoured Infantry soldiers for attack purposes.

Of course no Gunner likes the idea of his guns being dotted over an area in case the enemy attacks with tanks. On the other hand no doubt guns that are suitably sited will be always used, and will be the deadliest enemies of the tank.

Looking into the future I foresee some form of shoulder weapon being the natural usual weapon against the tank. That shoulder weapon would be with each Infantry Battalion, manned perhaps by the members of the Tank Corps if Infantry think they already have too many different weapons to carry.

To make Anti-tank defence the job of the Tank Corps would appear to be the most satisfactory solution of the problem.

The Chairman: Ladies and Gentlemen, it is left for me to sum up. Nobody wants war, in fact everybody hates it, but it is the duty of the soldier directly one war is over to think of how to defeat the King's enemies in the next. The Great War saw the development of two new Arms (as this is a gunnery lecture, I do not apologise for talking gunnery shop) and in them the appearance of two principal targets for the artillery; one the aeroplane, the other the tank. There are some people who now go so far as to say that in the next war there will be nothing but tanks and aeroplanes. I do not believe it; we shall have more machinery, but no war will ever be finished

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with tanks and aeroplanes alone. I think that the battle of 8th August, 1918, gave us the best line of thought for the future, or rather the best line along which we may start thinking about the future; it was Lord Rawlinson's—the 4th Army's—battle. There we had more tanks than we had ever used before, conditions for their employment were favourable in every way, and we had unlimited ammunition. I had something to do with the gunning of that Army, as you know, and some of you will be surprised to hear that I could get enough field and heavy guns for it and could get the ammunition, but the anti-aircraft guns bothered me; I could not find enough. Poor General Budworth, whom some of you knew very well—I am sorry to say he has gone—wanted anti-aircraft guns for every advancing unit and he was not very far wrong.

Protection of our troops from the air and tanks are the two main gunnery problems that we can foresee at the moment. There may be many other ones before we go to war again. Then we come to the gun of the future. In France, when the war had been going on for some time, we asked for experiments to be carried out with what we called a gun howitzer (a weapon with many of the advantages of the gun and some of the advantages of the howitzer); to have this weapon with a split trail so that it had a traverse of about 25 or 30 degrees in order to deal with tanks, and with an elevation that would allow it to engage targets in the air. I am of opinion that we cannot go on with anti-aircraft artillery pure and simple, most of our guns in the future will have to fire an air barrage just as they fire a land barrage now. I know that there are mechanical difficulties and inventive difficulties, and so there were, for example, before wireless telegraphy was a commercial possibility, but I believe that this is the weapon for which we gunners must work. Of course we have no money now, we shall probably not have any money until too late, but I think we ought to get on as Lord Horne said with experiment and design in the direction indicated. There was one other point the lecturer talked a great deal about—ammunition. I think the expenditure of ammunition is a point that all gunners ought to study very carefully; I could tell you facts about the demands for gas shell and smoke shell in France that you would hardly credit. You must remember the poor man at the dispensing end. If you demand in the field an over-proportion of anything, you will lessen the supply of necessary things; it is a very serious thing changing a manufacture of any sort, especially when you have the organisation for it in full swing. We are not allowed to talk politics by the Rules of this Institution, but I would like to say one thing about 1918, which I do not think has ever been said in public before; that is, that we owe a tremendous lot to Mr. Winstone Churchill for the way in which he made our ammunition expenditure and our gun expenditure possible in that critical year. He did a great deal towards winning the artillery battle. He certainly shortened the war; he put his priceless energy and his great brain power into Artillery supply and his "drive" made an enormous difference. When you got an expenditure of 24,000 tons of ammunition in 24 hours, to put it mildly, you are apt to strain resources. The lecturer remarked that nobody thought of cutting barbed wire by shell-fire before the war. I cannot make out why

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we did not; barbed wire had been used in Bulgaria, Serbia and Japan, but the business of cutting it by means of artillery fire never seems to have been taken up. One other remarks about tanks. We are on the top of tanks in the artillery at the moment because tanks are not shell proof. When they are made shell proof they will become slow and we shall still have armour-piercing shell to destroy them with. In asking you for a vote of thanks for the lecturer I may say that I rather spoilt his lecture by telling him that it might be too long, and he left out a very interesting part on counter battery work. He said he could have talked for over an hour on this subject alone, and I am sure very well. I would now ask you to pass a vote of thanks to the lecturer for a most interesting lecture.

The resolution of thanks was carried by acclamation and the Meeting then terminated.

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SUGGESTIONS FOR THE ORGANIZATION OF DIVISIONAL ARTILLERY.

BY MAJOR W. GORDON, D.S.O., R.G.A.

WHEN computing the organization of a Divisional Artillery the first point to consider is the organization of our Expeditionary Force Divisions. These Divisions are organized and equipped for independent action in moving warfare, and each roughly consists of :—

(a) Headquarters.
(b) Three Infantry Brigades of four battalions.
(c) Divisional Artillery.
(d) Necessary Services (Engineers, Signals, Medical Transport, Supply, etc.)

It must be borne in mind that, in the moving warfare of the nature for which the Division is to be prepared, no assistance in the way of reinforcements of men or replenishment of stores can be looked for from Corps or other Higher Formations, and very little from the Base and Lines of Communication. A Divisional Artillery must therefore be able to stand by itself both as regards its primary object of affording support to the Infantry and as regards its secondary object of supplying ammunition and "fireworks" to all branches.

As regards Artillery Transport this paper deals only with motor transport for Field and Medium Artillery Brigades, it being clearly understood that this may be exchanged wholly or in part for Horse transport as required by the conditions of the campaign. In any case, whatever the form of Transport it must be managed and driven by Artillery personnel.

A Divisional Artillery is at present organised on much the same lines as it was in pre-South African War days. The two additions which were made to it as a result of experience in that war, namely medium artillery and brigade ammunition columns, were dropped as a result of early experiences of trench warfare in the late war. Later experience in moving warfare brought out the necessity for attaching medium artillery to divisions and for using sections of the divisional ammunition column as temporary brigade ammunition columns. This could only be looked on as a makeshift, and the necessity for putting them both on a permanent basis must be accepted as we are now training and organizing for moving warfare.

The permanent posting of at least one brigade of medium artillery to a division is especially important to enable it to attain the very high standard of "liaison" with the Infantry which has already been attained by the Field Artillery and which has done so much to inspire

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the Infantry with confidence in its artillery. Further advantages would be the betterment of the liaison between the field and medium artilleries, the clearer definition of the position of the C.R.A. Division as regards his responsibilites for administration and training of medium artillery in peace as well as war, and the opportunty it would afford for practice in handling of medium artillery by the Divisional Command.

In order to afford closer support to the Infantry it seems advisable to introduce a unit of Foot Artillery armed with some such weapon as the 3·7-in. howitzer, normally in draught but prepared to take to pack transport for short periods as occasion demands. A brigade of three batteries would meet the case, each battery being attached for all tactical purposes to an infantry brigade while remaining under its own Foot Artillery brigade commander and the Divisional C.R.A. for administration and technical training. This arrangement would allow of at least one section of a battery being allotted to each battalion in the front line in the normal attack or defence.

Next in importance to supporting the Infantry comes the Artillery's second duty of ammunition supply, both for its own guns and for the rifles and machine guns of the Infantry. Divisional and Brigade Commanders will look to their own Artillery Commanders for this service, to carry out which an artillery commander must have an ammunition column at his absolute disposal. In addition Brigade Ammunition Columns are necessary for the supply of reinforcements to the batteries, replenishing men, transport, technical stores and ammunition from the Base, by means of the Divisional Ammunition Column.

Taking the above points into consideration a divisional artillery must include one Field Artillery Brigade, for each Infantry Brigade, one Medium Artillery Brigade, and one Foot Artillery Brigade, with a Divisional Ammunition Column. It must also have a complete echelons of such services as engineers, signals, ordnance workshops and transport workshop. On this a Divisional Artillery must be put down as :—

(a).	Headquarters.				
(b).	Three Field Artillery Brigades	12 Batteries	=	48	= 76 guns.
(c).	One Medium Artillery Brigade	4 Batteries	=	16	
(d).	One Foot Artillery Brigade	3 Batteries	=	12	
(e).	Divisional Ammunition Column.				

Each Brigade would have its own Ammunition Column consisting of an Artillery Section and, in the case of a Field Artillery Brigade an Infantry Section as well.

Divisional Artillery Headquarters must be increased to include Counter-Battery Staff, Headquarters Field Company R.E., Survey Section, and Divisional Inspector of Machinery (with workshops); it would thus consist of :—

(a). C.R.A.
(b). Brigade Major. (O and MS).
(c). Staff Captain (Counter Battery and I).

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(d). Staff Captain. (A and Q).
(e). Orderly Officer (Camp Commandant and assist with Counter-Bty.)
(f). Signal Officer (Captain R.A.) with Signal Section.
(g). O.C. Field Company R.E. with Headquarter Section.
(h). Survey Section (to include Flash Spotters).
(i). Inspector of Machinery (Captain R.A.O.C.) with workshops.
(j). Clerks and Batmen.

The Signal section must be an artillery unit. The high speed telegraphists of the Royal Corps of Signals are wasted on a unit which deals in technical artillery work by telephone and visual. Also, an outlet for advancement and promotion is needed for battery and brigade signallers. At the same time this unit must not be starved in the way of material as it will be the source of supply for all telephone and signalling stores throughout the divisional artillery.

Without the R.E. dumps of stationary warfare to fall back on the need for some sort of Engineer and Pioneer service will be felt. Hence the addition of the Field Company R.E. with its sections distributed out to the artillery brigades.

Counter-battery work, in stationary warfare carried out by the Corps, devolves on the Division in moving warfare, for this reason, as well as for carrying out normal artillery survey work such as the fixing of points and the erection of bearing pickets, a Survey Section becomes necessary. This section will include Flash Spotters, and not Sound Rangers, as they are less cumbrous and more likely to speedily and accurately locate enemy batteries in the positions they will probably occupy in moving warfare.

The Inspector of Machinery will do the work of an I.O.M. as regards the guns and technical stores, and at the same time will be to the artillery transport what the veterinary officer was to the horses. Like the Signal Officer, his organization stretches down to the brigades and batteries where his department is represented by junior Inspectors of Machinery.

Field and Medium Artillery Brigade Headquarters are formed on the lines of Divisional Artillery Headquarters and would consist of :—

(a). Brigade Commander (Lt.-Col.)
*(b). Second in Command (Major).
(c). Adjutant. (O.I. and M.S.)
(d). Quartermaster. (A. and Q.)
*(e). Signal Officer (Lieut. R.A.) with R.A. Signal Section.
*(f). O.C. Section Field Co. R.E.
*(g). Medical Officer.
(h). Inspector of Machinery (Lieut. R.A.O.C.) with workshops.
(i). R.S.M. & Q.M.S. (W.O. Class I.).
(j). Clerks, Draughtsmen and Batmen.

In the Headquarters of a Foot Artillery Brigade the appointments marked * would be omitted as it would be merely an Administrative and Instructional formation.

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The addition of a second-in-command would be most valuable; amongst other things he could act as liaison officer or perform any other duties for which it is usual to take a battery commander away from his battery. At a pinch he might even take over command of a battery. Generally he could understudy the C.O. and relieve him to a great extent from routine administrative duties.

The Infantry have always found enough work for a quartermaster in a battalion, and in the Artillery he could do much to relieve the battery captain from office work and free him for his more important duties. Economy can be gained without loss of efficiency by the centralization in the Brigade of the storage of certain seldom used spare parts, technical tools, etc. : this would be especially useful in the Foot Artillery where the reduction of weight with the battery is so essential : in other branches of the artillery it will become all the easier as motorization of transport tends to draw together the wagon lines of a brigade which have up to now been scattered in search of water, cover, and protection for the horses from the weather.

All batteries must be on a four-gun basis. Four modern guns produce as much fire effect as can be effectively run by one man. The introduction of foot artillery will do away with many of the reasons for making detachments, the need for which was one of the chief claims for a six-gun battery.

As regards the personnel of a four-gun battery the chief difficulty we have all experienced is the shortage of men and officers due to the fact that War Establishments are drawn up on the basis of bare requirements in action plus ten per cent spare. The lower ranks might well be increased to include a proper establishment for all Messes (Officers', Sergeants' and mens') clerks, sanitary men, water men and the various orderlies detached to divisional and brigade headquarters and ammunition columns. A great relief would be afforded to the batteries if a more liberal establishment were given to the headquarters of the higher formations.

An extra subaltern above and beyond section commanders is a necessity in a four-gun battery. It must be reckoned that one officer per battery will always be away either sick or on leave or on a course of instruction or doing someone else's job for him, and moving warfare with less than four officers in a battery is next door to impossible. Besides an officer is required in peace-time to train and organize the battery staff and act as G.P.O.

Every Officer in the chain of command is understudied by the senior of the rank below him until it comes down to the subaltern, to replace whom a sergeant has to be withdrawn from his sub-section. Consequently any casualty among the officers of a brigade has eventually to be replaced in the rank of subaltern by a man who may be an excellent number one but who has had little training and less practice in the duties of an officer. It is contended that the proper person to replace an officer is a warrant officer, and at present there are not enough of them. It is therefore suggested that in addition to the battery sergeant major there should be a new rank of section sergeant

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major (W.O. Class II). The section sergeant major can take charge of the section in the wagon line when the section commander is at the guns and vice versa. He can assist an F.O.O. or even act as one himself. He naturally steps into the place of his section commander when he becomes a casualty. In the same way the battery sergeant major would replace the officer of the battery staff.

All Batteries would then consist of :—

(a). Battery Commander (Major).
(b). Captain.
(c). Officer of the Battery Staff (Subaltern).
(d). Two Section Commanders (Subaltern).
(e). Battery Sergeant Major. (W.O. Class II.)
(f). Two Section Sergeant Majors. (W.O's. Class II.)
(g). Four Sub-sections.
(h). Battery Quartermaster Sergeant.
(i). Staff Sergeant Inspector of Machinery and usual Artificers.
(j). Battery Staff and Signallers.
(k). Sanitary men and waterman.
(l). Clerks, cooks and batmen.

The Brigade Column, working if necessary off the roads and using the same nature of transport as the batteries of its brigade, would supply ammunition to battery wagon lines and, in the case of field artillery to infantry battalion transport lines. A field artillery brigade ammunition column would therefore be composed as follows :—

(a). Commander, (Captain).
(b) Two Artillery Section Commanders (Subaltern).
*(c). One Small Arm Section Commander (Subaltern).
(d). Battery Sergeant Major and Quartermaster Sergeant (W.O. Class II.)
(e). Two Section Sergeant Majors, (Artillery).
*(f). One Section Sergeant Major (Small Arms).
(g). Staff Sergeant Inspector of Machinery.
(h). Four Sub-Sections (Artillery).
*(i). Two Sub-Sections (Small Arms).
(j). Sanitary men and water men.
(k). Clerks, cooks and batmen.

Medium and Foot brigade ammunition columns would be identically the same except that the small arms units marked * above would be omitted.

The Divisional Ammunition Column, working on the roads with lorries, would form dumps of ammunition and feed the brigade columns. It need not be a large organization, and would consist of :—

(a). Commander (Major).
(b). Captain.
(c). Four Section Commanders (Subalterns).
(d). Battery Sergeant Major.
(e). Four Section Sergeant Majors.

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(f). Battery Quartermaster Sergeant.
(g). Eight Sub-Sections (N.C.O's, Drivers and Loaders).
(h). Staff Sergeant Inspector of Machinery and usual Artificers.
(i). Sanitary men and water men.
(j). Clerks, cook and batmen.

The usual objection to every improvement is based on lack of funds : none of the suggestions put forward are really costly, and would be more than met from the savings effected by reduction to four-gun batteries and motorization of transport. The advantages of a real live organization for war existing in times of peace cannot be over-estimated. Efficiency and economy will come if a soundly organized artillery with its own transport and signal service is allowed to work out its own salvation.

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THE 42-CM. MORTAR: FACT AND FANCY.

LECTURE BY CAPTAIN BECKER, GERMAN ARMY.

Reprint from Artilleristische Monatshefte, July—August, 1921.*

Reprinted from the U.S. Field Artillery Journal, May—June, 1922.

WHEN in August, 1914, the first shots of Erdmann's battery destroyed the strong forts of Liege; and when one Belgian or French fortress after another, including even the central redoubt of the Belgian army, the "impregnable" fortified camp of Antwerp, fell to our big guns, not only Germany but the whole world was startled. In the old contest between gun and armour, the gun had scored another victory. Even among our German regular officers, 99 per cent, were entirely surprised by the new weapon. Soon after the fall of Liege, postcards began to appear, authorized by Army headquarters, showing conclusively the effect of the projectiles on armour and concrete.

It is not to be wondered at, then, that a mythology grew up about this weapon, which spread rapidly among the people and concealed the truth. The myths begin even at the cradle of the 42-cm. mortar. It is popularly believed that the Krupps were its sole creators; that Friedrich Krupp had built it secretly, hidden it in a closet, and presented it as a great surprise gift to the German Army on mobilization. As a matter of fact, the Great General Staff had formulated the demand for a piece of artillery which could quickly overcome strong armoured concrete works; this piece was developed through several years of constant co-operation between the Artillery Test Commission and the Krupps. The work of the firm was of the utmost value, but so was that of the Commission, and particularly that of its president, Sieger. The credit for the second model, adapted for road transport, is especially due to him. More even than in the development of the gun, the influence of the Commission is to be seen in the development of the proper projectiles, explosives and fuses. Great difficulties were encountered in these, and solved largely through the work of Major Arnold, the Foot Artillery projectile expert.

I, myself, as an assistant in ballistics, did some of the preliminary work on range tables in 1911. Experiments were in progress with the gun, carriage and ammunition, for several years before the war, at the Krupp proving grounds at Meppen, at Kummersdorf, Thorn and Jüterbog. Hundreds of men of the Commission's proving ground battery were instructed in the use of this material and were discharged. Many of the civil employees of the proving grounds knew all about it.

* Translation by Col. O. L. Spaulding, Jr., Field Artillery, U.S. Army.

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I remember, for example, a visit to the targets, when the driver of my motor car pointed out an unexploded 42-cm. shell lying beside the road. It appeared that he knew its weight, its explosive charge, and its initial velocity. In spite of all this, the secret was absolutely kept both at home and abroad—greatly to the credit of all those connected either with the Krupps or with the Commission, who had to do with the development of the material.

All sorts of fables grew up as to the handling of the gun. Early in 1915 a pamphlet was published, in regular catch-penny form, which told the most extraordinary yarns about the "big Bertha." Even serious papers circulated some of these stories. One of the big Berlin newspapers printed an account of the action of Solf's battery at Fort Manonviller, fairly accurate for the most part, but saying that "the guns were served by elegant gentlemen in cutaway coats," meaning thereby Krupp's engineers. These Krupp engineers filled everyone's imagination; in the summer of 1915, visitors to my battery before Kovno asked where they were. The actual fact is, that the commanders of the first 42-cm. batteries, at mobilization, were captains from the Artillery Test Commission, to whom the material was already familiar. Most of the battery officers were of the active army, assistants to the Commission. In a few cases employees of the Krupps were assigned as battery officers, and even as battery commanders; these, however, were not "Krupp engineers," but retired officers employed by Krupp, who had worked with the material on the proving grounds. All the men were regular Prussian artillerymen. In the three batteries first organized on mobilization, about one-third of the men were detailed from the active list of the proving ground battery; two-thirds were reservists, who had served in that battery or at the School of Fire. Later in the war, and especially when more batteries were put in the field, this selected material was not available, and there was even less chance of getting "Krupp engineers" for cannoneers.

It seems not out of place to give here some data on the material and ammunition, since the fable writers have touched upon these also. I am sure that, in our present situation. I can not be charged with divulging military secrets.

We had at the outbreak of the war two types of 42-cm. mortars. The older type, the "gamma" model, was the heavier, but the better ballistically. Gun and mount, in firing position, weighed 175 tons. For transport it was divided into several parts, to be carried on railway cars. The heaviest load was 26 tons. A special firing spur had to be built from the nearest permanent track. The gun was mounted and dismounted by means of a special portable crane; either operation required about 36 working hours. Adding the time necessary for building the spurs, it will be seen that days or even weeks were required for getting one of these "gamma" batteries into action.

The newer type, the M model, had been much lightened, at the expense of its ballistic efficiency. The weight in firing position was 42.6 tons. It also was separated into several loads for transport, but these were adapted to motor transport, and could make 7 kilometres

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an hour on good roads, or even sometimes more across country. The heaviest vehicle, loaded, weighed 18 tons. This weight caused difficulties at road bridges and culverts, especially in Russia, but these could always be overcome by means of the bridge baulks carried along for use in mounting the piece. These were of metal, U-shaped in cross-section, and so designed that they would carry the weight of the heaviest vehicle when supported only at the ends. In the summer of 1915 I succeeded in crossing stretches of Russian swamp with these. It required only a few hours to set up this piece.

Except for the use of cranes, made necessary by the heavy weights of material and ammunition to be handled, there was little difference in the service of the piece as compared with lighter guns. The newer model of 42-cm. mortar is an enlarged copy of the 21-cm. Many stories of the peculiarities of service must therefore be added to the list of fables. It was said that the air pressure was so great when the piece was fired that the gun crew had to take cover and fire by electricity. Other journalists went even further; the improved story was that after loading and laying, the whole gun crew was carried a kilometre to the rear in motor trucks; one man remained behind, lighted a fuse connected with the powder charge, and then followed on a motor cycle. Of course, there is not a spark of truth in all this. The firing was originally done precisely as with other guns; the shields protected the crew, so that they felt the blast less than others standing near. It was not until 1916 that orders were issued requiring that the piece be fired from cover by means of a long lanyard; and this was not on account of the blast, but because there had been several cases of bursts in the bore.

The ballistic qualities, also, were greatly exaggerated. Ranges as high as 100 kilometres were attributed to "big Bertha." Unfortunately, the actual ranges were very modest—14 kilometres with the railway model, and not much over 9 with the newer gun. The mobility of the latter had been purchased at the cost of 30 per cent of the range.

The weight of the long projectile for the railway gun was 920 kilograms, or about the same as our old field gun in firing position. For the lighter model, the projectile weighed 800 kilograms. The muzzle energies were respectively 9000 and 4000 metric tons.

Extraordinary accuracy was attributed to the big mortars. In deflection this was a certain extent justified; the guns responded accurately to changes of two minutes of arc. In range they showed much the same dispersion as other guns, and this dispersion increased materially during the war by reason of the wear of the guns and the falling off in quality of ammunition. Precise data as to dispersion were scanty before the war, experimental firing being restricted because of the cost of ammunition and the wear on the guns; but enough had been done to permit plotting a dispersion diagram on transparent cross-section paper. I have used such diagrams to calculate the amount of ammunition needed for any given target. They were issued to the extra-heavy batteries and to higher artillery commanders upon

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mobilization, but I have never seen them used except in my own battery. If they had been, much ammunition would have been saved, and much disappointment avoided.

It has been very commonly reported that the 42-cm. batteries each had a lighter gun for fire adjustment. This was of course not the case; adjustment was made with the heavy calibre.

As shown by many photographs, the 42-cm. shell was effective against the heaviest armour and concrete of the Belgian forts. As typical of this effect, I recall in particular two hits made by my own battery on the Fort of Wavre St. Catherine, in the outer line of forts of Antwerp, on September 29, 1914. On the evening before, I had fired a few rounds at the fort for adjustment. On the morning of the 29th I fired with the second piece, the more accurate, at the heavy guns in the armoured cupolas, while using the first piece against the concrete casemates. The conduct of the fire was a pleasure to an artilleryman, especially in the beginning. Half a minute or a minute after the telephone warning "on the way," the projectile could be heard approaching. "The train is coming," my telephone operator used to say. Now it was time to direct the telescope upon the air just above the target; with a little practice the shell could be picked up in the air and the impact itself observed. On this day, I saw my eleventh shot strike fair upon the top of the cupola, where the enemy's guns were actively firing. There was a quick flash, which we had learned at Kummersdorf to recognize as the impact of steel upon steel. Then an appreciable pause, during which the cupola seemed uninjured; then a great explosion. After a few minutes the smoke began to clear, and in place of the cupola we saw a black hole, from which dense smoke was still pouring. Half the cupola stood upright, 50 metres away; the other half had fallen to the ground. The shell, fitted with a delayed action fuse, had exploded inside. When I visited the fort later, I found a clean round hole in the part of the cupola that had been thrown to one side, punched out by the projectile. The head of the shell was found in the demolished tower, still sharp— a striking testimonial to the excellence of the material and workmanship.

A little later, I got another clean hit on the same fort, which exploded the magazine. A cloud of smoke shot up a thousand metres; numerous small explosions followed, and the whole fort took fire.

I have mentioned these details, because they concerned my own battery. This bombardment is interesting also because I have a detailed description of it from the other side. The father of one of my cannoneers sent me a copy of the Amsterdam "Algemeen Handelsblad," in which was published a letter from a Belgian artillery officer, who had been in the fort at the time, and who was later wounded at the fall of Antwerp and escaped over the Dutch frontier. It describes very vividly the fearful effect of the German 42-cm. mortars, and gives many details, especially of the effect upon the men of the garrison.

Later on the Belgian forts, especially those of Antwerp, were studied technically by the German engineers. It was found that the surprising effect on concrete work was due to the poor material. A

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pioneer officer said to me in October, while we were examining one of the captured forts, that the Belgian government had been shamefully defrauded by its contractors. I have not the technical knowledge to form an opinion on this; in any case, the actual effect of the 42-cm. mortars speaks for itself.

It is also said that our 42-cm. shell had little effect upon the French forts, such as Manonviller, Vaux and Douaumont, where good concrete was used. I know personally only Douaumont. This fort was hit only a few times by the 42-cm. shells; so we can not conclude, from the comparatively small amount of damage, that they lacked power. As to the other forts I can offer no opinion.

The shell effect was so great, at the very beginning, that legends soon grew up in regard to this also. Even our own higher commanders were not free from undue optimism, and often assumed that any fort could be demolished with a few shots. When it was not, the poor battery commander was blamed. They were surprised, too, if a work, assaulted after long continued fire, was found to be occupied. For instance, Fort Wavre St. Catherine, whose bombardment has been described above, was not assaulted until two days after the fire had ceased. Patrols then found it occupied; and I promptly heard from General Beseler's headquarters. My battery was turned upon the ruins again; an assault was made as soon as the fire ceased, and the fort was found abandoned. One may readily see, from the pictures of these heaps of ruins, what fine machine-gun nests they make. If the enemy abandons the work during the bombardment, but is given time to re-occupy it before the assault, no amount of destruction will do any good.

The attack on my second target, Fort Koningshoykt at Antwerp, was better managed. I had my observation station in the infantry outpost line; as soon as I ceased firing, the infantry followed my last shot into the fort, and occupied it without resistance, before the enemy had time to return.

The nature of the 42-cm. mortar and its projectiles make it particularly adapted to deep targets under strong horizontal cover. Through failure to appreciate this, it was often used against every possible or impossible sort of target, as a sort of maid of all work. Then, when it was used, over the protest of the battery commander, and got no effect, everyone was disappointed. I do not object so much to using it sometimes against field targets, when the weapon is still unfamiliar to the enemy, so that the moral effect is very great. Such fire proved well worth while at the crossing of the Danube in the Servian campaign. On this occasion I was on the left flank; my battery fired only five shots. Three of them fell on the commanding Goritza heights, on the south bank, and drove the cannoneers from the Servian guns in position there; the other two fell in the suburb of Ram, on the south bank, with great moral effect.

On the western front it was different. The enemy soon found that the effect upon shallow targets was mostly moral. I was called upon to fire for weeks upon shelter trenches, and only a few rounds a day were allotted. That this was sheer waste of ammunition I pointed

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out again and again, but without success; everyone swore by the moral effect, and was greatly disappointed when the poor results justified my protests. Hundreds of rounds were thrown away in firing upon cities and villages, such as Nieuport, Ypres and Dixmude. The 42-cm. shell weighs as much as eight 21-cm., and the eight give vastly more effect than the one against such targets.

The worst case of failure to appreciate the characteristics of the 42-cm. material was in February, 1915, when it was proposed to use my battery against English armoured ships, which were annoying our right flank in Flanders. One need not be a coast artilleryman to see the uselessness of this. This time, fortunately, my protest had its effect, when backed by the opinion of the chief munitions officer. But I got other extraordinary targets, little less suitable. In Nieuport, a little place on the coast west of Ostend, which was then just behind the enemy's line, there is the so-called Templars' Tower, built in the middle ages, with thick, heavy walls, and giving fine observation over the low Flemish country. There was an old saying that the town was impregnable so long as the tower stood. I was ordered to demolish it. Now at that range my mortars had an angle of fall of almost 70°, so that their target would be only the horizontal section, perhaps ten metres square. The probability of hitting was negligible; but for a flat trajectory the target was an easy one. I discussed the pros and cons at headquarters of the Fourth Army, in the presence of a representative of General Headquarters, but to no purpose. To all my objections the answer was, "they surely can't miss such a huge target." I finally offered, if there were no 15-cm. rifles available, to run a heavy field howitzer into the front lines during the night, and destroy the tower at daybreak, with the heaviest charge and flat trajectory, at a range of 2000 metres; but the orders for the 42-cm. mortar stood.

The ammunition allotted for this purpose was 200 rounds. Instead of giving it to me without reservation, so that I could fire it all on a day when conditions were favourable, the division to which I was attached gave it out ten or twenty rounds at a time, over a period of several weeks. I had to fire a few rounds a day at the tower, along with other firing, even some of it into invisible areas, where battery positions were noted on the very bad maps. My continued protests against this waste of ammunition accomplished nothing except to get me disliked by the division commander and the chief of artillery. I might have accomplished something by a little trickery, saving a few rounds on one day and expending it on another; but the artillery commander sometimes counted my shots. Finally the chief munitions officer put a stop to this useless shooting. A year later a battery of 15-cm. Navy rifles knocked down the tower in a few rounds, which might just as well have been done in February of 1915.

Other batteries fared no better. Scharf's battery, near Arras, had to fire its precious ammunition at the supports of the aerial cableways of the mines, because there were supposed to be observers up there. All of which emphasizes the necessity of having first-class artillery advisers at all higher headquarters.

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In contrast to these cases of overestimating the 42-cm. mortar, there were also cases of underestimation. Some of these errors have crept even into official documents. In Volume I. of the "Battles of the World War," published by the National Archives, I read that the two 15-cm. armoured turrets of Fort Koningshoykt were still serviceable after the bombardment. This is not the case. I conducted this fire from an advanced infantry post close to the left shoulder angle of the work, so that I was as well placed to see as the observers at the targets on the Kummersdorf firing ground. Both the 15-cm. turrets fired very actively at first. Just as our own regulations prescribe, the turrets were turned with muzzle to the rear after each shot. Just after one of the turrets had fired, one of our projectiles burst in front of it; this turret never moved again. The second turret continued its fire a short time after this, and then was put out of action in the same way.

Inspection after the capture of the fort showed that both turrets were jammed by injuries to the concrete work. Repairs by the troops proved impossible. Later on, I inspected all the Antwerp works in company with one of Krupps' representatives, who was in charge of repairs; his employees had to work for days to get these turrets in action again. The writer who speaks of the ineffectiveness of the 42-cm. shells at Antwerp evidently did not see these works until the repairs were well under way. Considering the use that was afterwards made of Antwerp as a German fortress, I think the way in which these guns were put out was better than the direct hit, such as described above in connection with Fort Wavre St. Catherine, where the turret was put permanently out of commission.

The attacks on the Belgian fortresses were at the pinnacle of the fame of our 42-cm. mortars. They were used to good purpose later, as against the Russian fortresses in 1915 and before Verdun in 1916. But as the trench lines became more extended and shallower, and better concealed, their effect diminished. Finally they were withdrawn from the front and their crews assigned to other guns.

Here I might make mention of the Austrian 30·5-cm. mortars, which so quickly gained a high reputation. I have seen these mortars on the march and in action, and found them astonishingly well designed and constructed for transport. In firing position, however, if the ground is not exceptionally firm, they have a tendency to get out of level, and fire has to be suspended for repairs. The shell effect is inadequate; at Fort Koningshoykt, for instance, after two days' fire from four of these mortars, the concrete work was not materially injured and the turrets were intact. A few hours of fire from my battery put the work entirely out of action. But in mythology the Austrian mortars have been very much played up, to the prejudice of ours. For instance, in the winter of 1914-15 a set of drawings was placed in the Schönbrunn palace, representing the work of the Austrian mortars. In the spring of 1915 these were reproduced in colours, and issued in a very fine portfolio form, under the title, I think, of "Our Motor-drawn Mortars in Belgium." Among these I was astonished to find several

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excellent sketches of 42-cm. shell craters. I was told of a similar incident in Russia in 1915.

The 42-cm. mortar was a wonderful tool. Even a poor workman could use it with effect. We who commanded batteries of them will always recall our experiences with pride and satisfaction. In 1914 and 1915, both east and west, they made a unique and decisive contribution to the victories of our incomparable infantry.

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BRITISH STRATEGY IN THE MIDDLE EAST.

A Lecture delivered at the Royal Artillery Institution, on Tuesday, 12th December, 1922.

BY MAJOR & BT. LT.-COL. F. W. BARRON, O.B.E., R.G.A.

Major General Sir W. Gillman, K.C.M.G., C.B., D.S.O., in the Chair.

CHAIRMAN : Gentlemen, I want to introduce to you Colonel Barron, who has very kindly come to lecture to us to-night on the Middle East and things connected with it. He has got a considerable experience of the countries about which he is going to talk, because he was at Gallipoli and in Egypt and Mesopotamia during the war, and since the war he has been for a considerable time at the War Office studying the questions about which he is now going to speak to us.

I will ask him now to go on with his lecture.

COL. BARRON : "Gentlemen, the subject upon which I am going to talk to you this evening is "British strategy in the Middle East". You know, of course, that the Middle East has, since the great war, assumed a very prominent place among our Imperial responsibilities, and so much is this the case that it has been found necessary to create an entirely new department of the Colonial Office in order to deal with the problems connected with it.

In this lecture I want to avoid political matters, as far as possible, and confine myself to the military aspect of the subject. But, as you know, "Strategy is the handmaid of policy", and it is therefore impossible to talk about the one without, in some degree, considering the other.

It is difficult to lay down definite boundaries, but perhaps we may take it that this "Middle East" includes, roughly, the whole of Syria, Palestine, Arabia, Iraq and Southern Kurdistan. Of these, the territories which principally concern us from the strategical point of view are Palestine and Iraq. I propose, therefore, to talk to you chiefly about these countries and to consider how we got there and why we remain there.

But before going on to that I think it would be as well to consider for a minute the pre-war conditions in the territories we are discussing and those adjacent to them. Before the war there was no British territory or even protectorate between the North-West frontier of India and the Mediterranean. In those days the chief danger to India was always considered to be Russia, and Russia had for many years been advancing by slow degrees towards India. And, in further-

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ance of her purpose, she had constructed many strategic railways, such as the Caucasus railway, and the Trans-Caspian or Central Asian railway, all leading towards the northern frontiers of India. She had also been spreading her influence rapidly southwards through Persia, thereby establishing a direct threat to the southern portion of the North-West Frontier via Baluchistan. With the object of putting an end to this latter threat we, in 1907, came to an agreement with Russia about Persia. This agreement included the division of Persia into three spheres. The northern, known as the Russian sphere of influence, extended from approximately Kasr-i-Shirin, through Isfahan, to the junction of the Afghan and Persian borders near Kushk. The southern, or British, sphere of influence extended from Bandar Abbas through Kirman to the Afghanistan border south of Herat. In these spheres Russian and British influences were supreme. In the central portion neither power had any official position. India, therefore, was defended, so far as the southern portion of the North-West Frontier was concerned, by a railwayless Persia, backed by a British sphere of influence. Her defence on the northern portion of the frontier was a friendly and railwayless Afghanistan, assisted by the tremendous physical difficulties of the country. In the years succeeding the Anglo-Russian agreement Germany began to take a hand in the Eastern problem, whether in view of her eventual determination to make war against Great Britain or for purely commercial purposes, it is not for me to say. But, in pursuance of her scheme, she devised a railway running from Constantinople to the head of the Persian Gulf. To this enterprise we, of course, being at the time at peace with Germany, could not raise any definite objections; but, with a view to safeguarding ourselves, we opposed the placing of the terminus at Basrah, i.e. in Turkish territory, and demanded that it should be placed at Koweit. Our reason for this was that the independent sheikh of Koweit was intensely pro-British, and, with the terminus of the railway in his territory we should, consequently, in case of war, have been in a position to exercise some control on the use of it.

When the war broke out the construction of the Anatolian section of this railway was nearly complete as far as Aleppo, where it joined the railway running in the hinterland of Syria and Palestine down to the Hedjaz. There were, however, two portions incomplete—one through the great Taurus range of mountains, and the other through the Amanus range. A portion of the railway from Aleppo towards Mosul had also been constructed, and another portion had been completed between Samara, on the Tigris, and Baghdad. Before this railway, therefore, could be of any real value in a military sense for operations in Iraq, or in connection with operations further east, a very large amount of difficult engineering work remained to be done. The railway, in fact, was completed up to Nisibin during the war, but no further extension has been undertaken since the Armistice.

After this very brief survey of the pre-war situation, I should now like to turn to post-war conditions, i.e. the conditions at the present day.

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At the end of 1918, when the armistice with Turkey was concluded, British forces were in occupation of Palestine, Syria, part of Cilicia, and the whole of the three vilayets of Iraq. In Persia, Russian influence had entirely disappeared owing to the collapse of the Russian armies after the Bolshevik revolution, and had been replaced by British influence, which was paramount all over Persia.

During the years succeeding the armistice certain changes and developments have occurred.

On the west we have withdrawn completely from Cilicia and Syria, for both of which countries the French accepted mandates, but have now returned Cilicia to its former owners, the Turks. It is reported that they are now considering the return of Syria to Turkey also, though nothing is known officially as to this. I mention it here because, if true, the immediate contact which would thus be set up between Turkey and Palestine would undoubtedly have a considerable effect on our policy in Palestine, and, through it, on our strategy.

You know, of course, that after the great war, the allies agreed that territories wrested from the enemy which were unfitted for immediate self-government should be, as it were, adopted by certain specified powers, with a view to educating them in the art of Government until they should be able to stand alone. Two of the countries for which Great Britain accepted these "mandates" are Palestine and Iraq, and I propose to say just a word or two about the way in which we have carried out our mandatory functions in these countries.

We have set up in Palestine a British government administration under the conditions of our mandate. How long it will be before we can fulfil our mandate and give self-government to Palestine it is difficult to say, because we have adopted the policy of making in that country, a "national home" for the Jewish race.

It is important to notice the exact wording with which this policy was defined. We did not say that we would make Palestine *the* national home of the Jews, but that we would make *in* Palestine *a* national home for the Jews. It is perhaps unfortunate that the difference in wording is so slight, as out of it has grown up a bitter dissension. There can be no doubt that the more extreme of the Zionists have not only expressed their intention of "making Palestine Jewish as England is British", but that a large number of them have endeavoured to translate this intention into fact. A very large number of Jewish immigrants have entered Palestine. They have come from all parts of the world, and it is an undoubted fact that many of them who have migrated from Russia have pronounced Bolshevik tendencies.

The Arab, who is the aboriginal owner of the soil, does not appreciate the fact that these extreme views are not in accordance with our expressed policy, but thinks that this Jewish immigration is part of a deliberate plan to oust him from the country which he and his forefathers have possessed through the centuries. As a result, a very difficult situation is created for us. It is obviously impossible to set up a govenment of Arabs, as they would immediately turn out the Jews, and thus our obligation to the Jewish race would be stultified.

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It is equally impossible to set up a government of Jews, as they would immediately squeeze out the Arab, and thus our principle of "self-determination" would go to the wall. And Jew and Arab will not, at present, combine in order to govern. Consequently we have only one alternative, and that is to retain the government in our own hands, and hope for the best.

To turn to Iraq. We have now withdrawn from all the territory which we occupied at the armistice, other than that included in the true geographical boundaries of the three vilayets. Some two years ago we set up an Arab council of state under the presidency of the British High Commissioner, with a view to teaching the Arabs to govern themselves. Obviously this could only be a temporary expedient, and something more definite was necessary before the country could become actually self-governing. Among other things, a head was required, and therefore, about eighteen months ago we introduced Feisal to their notice as a candidate for kingship. He was accepted as King, and an Arab government was formed (with the British high commissioner in an advisory capacity only, subject to certain rights of veto). There have, of course, been difficulties to overcome, and we have passed through some anxious times (one of them, and perhaps the most anxious, quite recently) but we have now concluded a treaty with King Feisal, constituting Iraq an independent state, which, it is hoped, may soon be admitted into the League of Nations.

As regards Persia, the situation is more obscure. Persia is, and always has been, a hot-bed of intrigue, and our influence, which at the end of the war was supreme, has been very largely reduced. The causes of this decline of British influence would be too lengthy to discuss here, but they were briefly, Bolshevist endeavours to undermine the strength of the British Empire, and economic conditions in England which led to the withdrawal of our troops and the cessation of loans to Persia. A year ago our prestige in Persia had practically disappeared, and although since then it has recovered somewhat, there is little doubt that current affairs in the Near East are being used by our enemies as a lever with which to upset it finally.

The loss of our influence in Persia is, of course, extremely serious; not so much for its direct effect in that country, but owing to the consequent loss of prestige which we have suffered, and may still suffer, throughout the East.

Now, with this description of conditions in the countries of the Middle East, I will pass on and try to answer a question which we have seen so frequently asked in the press, i.e. "Why do we remain in military occupation of these countries—Palestine and Iraq—at all?"

In Palestine we are compelled to remain, as I have just said, in pursuance of our policy of establishing a national home for the Jews.

In Iraq we remain for three principal reasons:—

Firstly, because, having constituted the independent state of Iraq we cannot honourably withdraw all support until its king and government has become firmly established.

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Secondly, because of the still further blow to our prestige throughout the East which would be caused by a precipitate withdrawal; and

Thirdly, because the British Empire has poured out millions of money and many thousands of lives in this territory, and there is thus a considerable amount of sentiment connected with it.

These reasons, you will observe, are either political or sentimental. From the purely *military* point of view, there is only one reason for maintaining a garrison in Iraq, i.e., to protect the Ahwaz oil-fields against any attack through Iraq. This could be done without keeping any troops north of the line Nasiriyeh—Amara—Persian border.

These oil-fields, situated to the north-east of Ahwaz, supply a very large percentage of the oil-fuel for our navy and mercantile marine. They are entirely under British control, and would be, in time of war, one of the very few sources of supply of oil which *are* under such control. The importance, therefore, of protecting them from attack or interference is sufficiently obvious. They are, in fact, a vital imperial asset. Were it not for the necessity of safeguarding them there would be no purely military object in maintaining any troops in Iraq at all.

You have, no doubt, often seen it stated by amateur strategists in the Press that there *is* a definite military reason for keeping troops in Iraq, i.e. that Iraq is being used as an outpost for the defence of India. If it is, I can only say that it violates one of the canons of selection of an outpost, i.e. it is so far distant from its main body, and so completely isolated as to preclude its exercising any definite function of protection, and to be exposed to defeat before support could arrive. But a little consideration will show that this outpost theory has no foundation in fact. Who are India's possible external enemies? They can only be three, namely, Afghanistan, Bolshevist Russia, or Turkey. Persia I leave out of account, as for military purposes, her forces are negligible. It is quite clear from the map that, should Afghanistan wish to attack India, no British force in Iraq could have any effect whatever. As regards Bolshevist Russia, I think it is obvious that if she wishes to attack India (I do not enter into the argument whether she *could* do so) she would not proceed by way of Iraq, but would go direct, and attack either from the south-east corner of the Caspian, through Afghanistan, or by the Trans-Asian railway. Otherwise she would commit herself to the enormous undertaking of marching through a country devoid of any railways and involving so much land transport as to preclude the support of fighting forces. As regards Turkey, the only *raison d'être* for an attack by her on India would be an attempt of the Mohammedan nations to combine to drive out the Christian peoples from territories held by them. Should such an event come to pass it is even then hardly conceivable that, in view of the enormous number of Mohammedans in India (and we should have in this case to include Afghanistan) it would be necessary for Turkey to try to send an army to India at all, and, even if she did, the distances to be traversed through a mountainous and difficult country, with no system of railways, would

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render the operation almost impossible. We may therefore also ignore a direct attack by Turkey upon India.

Consequently it is true to say that Iraq has no direct influence in a military sense in the defence of India. Even more must this be the case as regards Palestine. Indirectly, however, there is the chance that both these countries might have an effect on the problem, as follows: If we are faced by an attack by Islam on Christianity, or by an attempt on the part of the peoples of India and Afghanistan to drive out the Europeans, our position in India will be gravely endangered, both by internal upheavals and by direct attack from Afghanistan. And it is then quite conceivable that the Turks might throw in their lot with their co-religionists, and simultaneously attack our position in Palestine, and still more in Iraq, with a view to compelling us to reinforce those countries, and thus infringe one of the great principles of military science, by making unsound detachments from the main theatre.

In such a case, what should we do?

I am not here considering the political aspect of the matter but am merely suggesting what ought to be our military policy. Surely it is obvious that, with a threat against the safety of India and all that its loss would mean to the empire, it would be criminal folly to detach troops to safeguard territory in which we have no military, and only a problematical financial, interest. We *must* safeguard our vital imperial interests—i.e. in Iraq the Anglo Persian oil-fields, and in Palestine the frontier of Egypt, but this should be the limit of our military commitments.

A retirement under pressure, however, as far as would be compatible with the carrying out of this task, would not only be repugnant to our British nature but it would also entail grave political disadvantages. It would mean disavowing our obligations to, and breaking faith with, the new king whom we have set up in Iraq, and the Jews whom we are establishing in Palestine. It would mean removing from both countries that stable form of government which we have been working for three years or more to establish, and the throwing back of both countries into complete chaos, or restoring them to Turkish rule (which, it must be admitted, was entirely adequate, though somewhat loose). And it would mean a further serious set-back to our prestige throughout the East.

Surely, if we wish to avoid these disasters, we must manage to remove the danger of attack. We have seen that the chief external danger, probably the only one, is from Turkey. Therefore our main purpose must be to make friends with the Turks.

Friendship with the Turk means, almost certainly, friendship with the whole Mahommedan world, and the establishing of a barrier, consisting of Turkey, Persia, and Afghanistan, between our avowed enemy, Bolshevik Russia, and our Indian possessions and Eastern communications. Remember that, though Angora and Moscow are at present in alliance, it is an alliance which, being between an essentially religious nation and one which openly repudiates religion, cannot

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possibly last long. There are many people in Great Britain who abominate the Turk on account of his behaviour towards the Armenians. These people, I think, forget that they are speaking of orientals, who cannot be treated in the same way as Europeans. The Turk undoubtedly has committed many atrocious massacres of the Christian minorities, but it is also a fact that those same Christians, where occasionally, they have found themselves locally in the majority, have committed equally atrocious massacres of the Turks. It must be remembered that in the hinterland of Asiatic Turkey there is little, if any, distinction between the peoples of the various creeds. They talk the same language, they sit in the same coffee shops, and the truth is that they are all tarred with the same brush. The reason for the Turkish hatred of the Armenian is really that the Armenian is very much too clever for the Turk, and that on the rare occasions when the Turk manages to collect any money it almost invariably finds its way rapidly into the pockets of the Armenian.

I have just referred to our Eastern communications, so, before closing, I should like to consider them for a moment.

There have been, for several years, discussions going on as to the possibility of railway connection, in addition to sea communication, between India and the Mediterranean.

Before the war there were no railways in Egypt east of the Suez Canal, nor any railways in Palestine. There were no railways in Iraq other than the short stretch of the German Baghdad railway some 70 miles in length between Baghdad and Samara. During the war several railways were constructed, for military purposes, in Palestine and Iraq, many of which have now been dismantled. There exists, however, to-day, through communication between Egypt and Jerusalem and the coast towns of Palestine, with a branch line leading to Deraa on the Hedjaz railway. In Iraq, there is a direct railway between Basrah and Baghdad, via the Euphrates, with an extension to within some 60 miles of Mosul.

Even while the war continued the obvious advantages of connecting Iraq and the Persian Gulf with the Mediterranean were being considered. The first idea for post-war development was the obvious one, that is, to fill up the gap between Nisibin and Shergat. Another proposal, which was put forward as part of a scheme of railway development throughout the Middle East, was to connect Baghdad with Alexandretta by a railway following the course of the Euphrates.

But there is a factor which very closely affects the question of the alignment for any Persian Gulf-Mediterranean railway, and that is the agreement which has been arrived at between the French and ourselves as regards our respective spheres of influence in Northern Arabia. Under this agreement which was signed in December, 1920, the boundary line between the French and British spheres passes approximately along the north-west border of Iraq and thence direct across the desert to the actual frontier between Syria and Palestine. It will thus be seen that, under either of the two before-mentioned

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schemes, the greater part of the railway would lie in French controlled territory.

It is obvious that for Great Britain, both from a commercial and military point of view, it is very desirable that the railway as finally constructed should lie throughout its length in territory which is under British control. During the past 18 months, therefore, reconnaissances have been made for a railway which would cross the desert between Haifa and Baghdad. The suggestion was that alongside the railway there should be constructed a pipe line by which the Mesopotamian oil could be led direct to the Mediterranean; and it was also proposed to establish a trans-Arabian air route which should follow the same alignment. The scheme for the railway and pipe line is temporarily in abeyance, partly for lack of funds and partly because of the uncertain conditions in Northern Arabia as between ourselves, the French, the Arabs and the Turks. The air route has, however, already been established between Cairo and Baghdad and is actually in working, and by its means official mails from Iraq, which used to take at least five weeks to arrive in London, are now being delivered in less than a fortnight.

As regards the actual alignment of the railway between Haifa and Baghdad, two main routes have been considered. One, which crosses the Hedjaz railway, approximately, at Deraa, and goes straight across the desert to about Ramadi, on the Euphrates. The other, which crosses the Hedjaz railway well south of Deraa, and proceeds down the Wady Sirhan Valley. It is obvious that, from a military point of view, this southern alignment is the better, as lying more completely within the British sphere of influence. Commercially it would appear to be better as it taps the Wady Sirhan, which is the only rich country in that part of Arabia. From an engineering point of view it is, I believe, better, since it avoids the high ground north of Jauf, although it is understood that there are great engineering difficulties at the actual point of crossing the Jordan. From a financial point of view it is perhaps the least satisfactory, owing to its being longer.

Should this southern alignment be eventually selected, a very important point which will arise will be as regards the terminus in Iraq. The scheme which I believe holds the field at present is to bring the new railway into Iraq somewhere in the direction of the Middle Euphrates—that is, about Kerbela or Nejf—and to make the terminus at Baghdad. The alternative would be to join it to the existing railway somewhere near Ur and to make the terminus at Basra. Commercially, the claims of the former are undoubtedly great. Baghdad is the political capital of the country and is on one of the main trade routes from Persia, and the Middle Euphrates area is probably the richest agricultural district of Iraq. From the military point of view, however (and we must remember that this railway, if constructed, will be very largely a strategic railway), there are certain grave objections to this scheme. The Middle Euphrates area contains the two great Holy Cities of Iraq. It is now, and always has been, the great centre of unrest and religious agitation, and to bring the railway into this area

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would almost inevitably lead to its being completely useless in the event of trouble in Iraq. Moreover, the natural features in this district —rivers, streams, canals, irrigation cuts, etc.—are such as to make the interruption of a railway very easy, and its repair, when damaged, extremely difficult. Hence we must, I think, from the military point of view, vote for the second alternative—that is, for the terminus to be placed at Basra, and regard river navigation on the Tigris as our only really reliable channel of communication with Baghdad, though the Euphrates Valley railway would still, of course, exist for this purpose in normal times.

The adoption of Basra as the terminus would also fit in with another railway project that has been put forward, i.e. the connection of Basra with India by a railway through Persia. Many suggestions have, from time to time, been put forward for railway development in Persia. The Persians, however, have apparently always suffered from the oriental suspicion of a railway, and we ourselves have always opposed the extension into Persia of any of the Russian strategic railways.

Towards the end of the war two proposals were put forward for railway development in Persia. The first involved an extension of the existing railway between Baghdad and the Persian frontier, through Kermanshah and Hamadan to Teheran, with a branch running by Yezd and Kirman to join up with Quetta via the existing Nushki Extension railway. This alignment would involve a great deal of very heavy engineering work, and, from a strategical point of view, I think, we must oppose it, since there would be only a short section remaining to be completed between Tabriz and Teheran in order to provide through communication to the India frontier from the Russian Caucasus system.

The alternative suggestion is to construct a railway from Basra, following the coast of the Persian Gulf, as far as Chahbar, and thence, either northwards to connect with the Nushki Extension railway, or to continue along the coast as far as Karachi. From a strategic point of view, this railway would undoubtedly be very valuable in that it would greatly decrease the time taken between Basra and India.

Before leaving the subject of railways, I must point out that the establishment of an air route to India may have a great effect on the eventual selection of the alignment. An air-route can only be operated if it is a paying proposition. This it cannot be if the aircraft have to reduce their useful load by carrying fuel for long distance flying. Hence they are dependent on being able to pick up petrol and oil at comparatively short stages. This petrol and oil can only be transported economically by rail. But, again, to be a paying proposition, an air route must touch busy commercial centres. From the air point of view, therefore, the best alignment for the air-route and railway would be through Constantinople and Anatolia—in fact, by the route of the old German Baghdad railway.

This, therefore, is a case where military and commercial policy may clash.

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Now, gentlemen, in conclusion, may I remind you that I have tried to avoid, as far as possible, the political aspects of our Middle East problems. The countries for which we have accepted mandates have undoubtedly a great future commercially if allowed a period of peace in which to develop. There are many anxious problems to be solved, and very great difficulties to be overcome. It is our part, as soldiers, to grapple with the military portion of the problems, and, having formulated a sound military policy, to recommend its adoption to those whose business it is to shape the destinies of the Empire. As you know, a conference of the powers is now sitting at Lausanne, with the single object of establishing a firm peace with Turkey. The result of that conference cannot at present be foreseen, but there are indications that agreement is in sight. If this, happily, is the case, there is, I think, a fair prospect that the peaceful development of the countries of the Middle East may at last bring to us an adequate return for the blood and treasure that we have expended upon them.

CHAIRMAN: Would any officer like to ask Colonel Barron any question on his interesting lecture?

MAJOR EADY: There are two points I would like to ask on Iraq, firstly, are the Mosul oil fields considered of sufficient importance to justify the Military occupation of Iraq; and, secondly, if the idea was that the Mosul oil fields ought to be protected would it be possible to keep in check the South Kurdistan people who are always causing trouble?

COLONEL BARRON: The question is whether the Mosul oil fields are of any essential value—I think that is what it comes to?

MAJOR EADY: Yes, of sufficient importance to justify a military occupation.

COLONEL BARRON: From a military point of view, the answer to that is this, that there undoubtedly is a lot of oil all round this area and there has been a certain amount of prospecting going on, but nobody can yet say definitely what oil there is there, or how much, or whether it is easily workable or what the cost of pumping it is going to be. Therefore, from the point of view of safeguarding an existing Imperial asset, which, after all, is the only reason for keeping troops anywhere, I think we must ignore the Mosul oil fields. At present it is too much of a problematical thing to be worth keeping troops there to protect. Your second question was?

MAJOR EADY: Whether the Kurds could be kept in check.

COLONEL BARRON: Yes, whether if we were to withdraw British control from Mosul entirely, anybody could control those Kurdistan tribes, who are the people living in this area along *here*?

If we withdrew from the Mosul area we should leave the Arabs defenceless except in so far as they could defend themselves. The Turks might or might not walk in there. The question is whether the Kurds would be able to be controlled at all. I think the answer is that nobody has ever yet succeeded in controlling the Kurds and I do not

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think they ever will. But I do not think the Kurds will ever be a definite danger to Iraq proper, for this reason, that the Kurd is a hillman and he will not come down into the plains to fight if he can possibly avoid it.

During the war in Mesopotamia we enlisted a great number of Kurds in the labour corps, and those Kurds were brought down into the plains but they never stopped very long; they used to desert and get back to their hills very soon. If it is a question as to whether we could control the Kurds by remaining, I do not think we could and I do not think anybody could. The Turks never managed to do so although they controlled the Arabs. But I do not think the Kurd situation will have much effect on the oil situation.

Colonel Lister: Would Colonel Barron give us a few words on what the present situation is of the French in Syria and as to whether the Sykes- Picot Agreement is in existence now or whether it has been abolished?

Colonel Barron: Colonel Lister is now asking a rather difficult question. I think the answer is that the French situation in Syria is very similar to our situation in Iraq, that is to say they are sitting in there with their troops but their troops do not like being in there. In fact, as I said before, within the last couple of months there have been rumours that they were desirous of abrogating their mandate for Syria in the same way as they did for Cilicia and handing it back to the Turks. There is very little doubt that the French dislike being there but I think they stay there chiefly for political and commercial reasons. That is really what it is. I cannot tell you anything about how many troops they have got there, at least I should have to have notice of that question. (Laughter).

As to the other point, the Sykes-Picot Agreement, I think, has died a natural death—we will put it in that way. The Sykes-Picot Agreement drew up various boundary lines of sorts, but they were all eventually conglomerated together at the time when the Anglo-French Convention decided on that boundary there (pointing on the map). Although I do not think it has ever been officially abrogated, I think the Sykes-Picot Agreement is really a dead letter, because it has been replaced by the Anglo-French Convention of 1920.

Major Athill: Would the importance of a great air route be sufficient to justify keeping troops in Iraq? I have heard people talking about the benefit of having a big inperial air route: Would that be of sufficient importance to warrant our keeping a garrison there?

Colonel Barron: The question there is I think what can we afford? Is the establishment of an air route a vital imperial asset? If it is, then it is worth our keeping troops in Iraq. If it is not, then it would not be, from the military point of view. I think that is the only answer.

Major Athill: I would rather like to know *your* opinion.

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COLONEL BARRON: Now we are getting into controversial subjects. My own view is that we have got a long way to go before an air route to India or the East is a really practical proposition—a very long way to go. This, mind you, is only my own view and you must not take it as being official in any way, but by the time we have developed aircraft to the extent of being able to make long distance flying a commercially paying proposition, we can then probably discuss the question further, and I think by that time— or I will not say *I think* by that time, but *perhaps* by that time—the League of Nations will be functioning. (Laughter).)

LT.-COL. MAITLAND MAKGILL-CRICHTON: Will you say whether anybody has seriously put up the idea of building the Southern Persian Railway? It would mean a good many millions. Has anybody taken it up as a firm proposition, or is it merely talked about?

COLONEL BARRON: It has certainly been seriously considered. I believe, although here I am speaking without the book, that that railway along the southern coast of Persia was proposed before the war in the course of many suggestions as to railway construction in Persia, but I know that towards the end of the war a certain general who was a celebrated railway expert came out to Iraq with a view to considering the whole question of railway development in Iraq, Arabia and Persia, and that that was one of the schemes which he had under consideration. It was very carefully gone into, in fact a survey was made of that southern coast.

CHAIRMAN: Anybody else?

CAPTAIN STANFORD: Is it not a fact, sir, that the question of the Haifa-Baghdad Railway running across there was gone into and that it was only turned down because the man who had the veto on it was the Chairman of the P. and O. and B. I., and had just bought the Tigris river fleet.

COLONEL BARRON: It may be so, but I never heard that—at least I did not hear it officially! No, I think the real reason it was turned down was financial absolutely.

CHAIRMAN: As there do not seem to be any more questions I want to make two remarks with regard to this lecture. The first is that whatever our ultimate policy will be as regards Iraq and Palestine it is a strategical necessity for us to safeguard the Suez Canal, and that, whatever monies are expended as war legacies in these two countries often to the detriment of establishments at Home, we must not economise on this imperial waterway. The second point is that I beg to differ with the lecturer in his desire for cultivating the Turks as friends owing to the value of its effect in India in particular and the Mahomedan world generally. In the Crimean war we helped the Turks against the Russians only to find two years later that the Indian Mahomedans were joining the Hindus against us in the Mutiny. In 1877-78 we again saved Constantinople from the Russian, and one year later we had forcibly to explain to the Afghans that we and not

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the Russians were to be their friends. From the point of view of propaganda the Caliphate movement made great headway in India, but the moment the Turks returned to Constantinople from Angora the Sultan was deposed, thus showing the shallowness of the whole idea. I mention these three incidents to back my opinion. I consider the Turk to be an Oriental, and as such I feel that we have nothing to gain by cultivating with him a friendship on which no reliance could be placed.

I would now like to ask you, gentlemen, to join me in thanking the lecturer very heartily for his most interesting lecture. He has covered a lot of ground, he has improved our geography immensely and at the same time he has given us a lot of valuable information which I am sure we did not know before—thank you very much. (Loud and continued applause).

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THE OFFICIAL HISTORY OF THE GREAT WAR.

Military Operations—France and Belgium 1914.

Compiled by Brigadier General J. E. Edmonds, C.B., C.M.G.

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Reviewed by

LIEUT.-GENERAL SIR H. S. JEUDWINE, K.C.B., K.B.E.

THERE are probably few officers of the army who took part in the war who have not at some time or another speculated on the shape that the official history would take, and, realizing the magnitude of the task that would confront the historian, expressed anticipations the reverse of optimistic as to the result of his labours. The publication of this volume recording a part of the military operations of 1914 marks, it is true, only a very small step towards the completion of the whole. But from it may be gauged the plan on which the whole record of military operations is intended to be based, and on it may be founded a confident anticipation that if its continuation remains in the same hands the result will be a history exceeding in value and interest any war history, whether of this or any other war, and whether official or due to private enterprise, that has hitherto been produced—in short a work worthy of the immensity of the struggle and of the deeds of our Army which took part in it. Indeed it is difficult to praise this volume too highly.

The war was a war of peoples, not only of armies. The story of the "Old Contemptibles", a part of which this volume tells, is consequently the story of the deeds of the advanced guard of that greater army of the nation in arms which was in the making while the fighting of 1914 was taking place, and which later crossed over to take its stand alongside its brothers in arms, and to fill the huge gaps in their sorely rent ranks, or sailed to other theatres of war to maintain there the reputation which the British Expeditionary Force had already won. It is natural therefore that the eyes of this greater army, of all its relations and friends, and in fact of the whole nation, should have been fixed on the swaying fortunes of that Force, leading up to and affecting as they did the part which it would have to play when it came to take the field. Consequently a requirement of any story of military operations in 1914 is that it shall be told in a style that will be attractive to and comprehensible by all elements of the Nation, and on a scale that will enable the human side of its episodes to be illustrated. In this Brigadier General Edmonds has well succeeded. His story lives, and preserves the romance which coloured the desperate and heroic struggle of 1914 without sacrificing the accuracy and impartiality which true history demands.

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It may almost be said that this is the primary requirement of an official history of this last and greatest of wars. There are others; the provision of material for the student, and the record of the doings of individual regiments. But these two requirements can never be fully met in a history of the war at large. To fulfil the needs of students history must be amplified and analysed by monographs dealing with particular events, such as some which have already been produced by officers of the German General Staff. And for complete record of the doings of regiments dependence must be placed on the divisional and regimental histories of which so many have either already appeared or are now being written. Yet these two requirements have not been lost sight of. The claims of all classes of readers have been well balanced. The result is a record which is lucid without being dry, and thrilling without being theatrical. The book is one which should appeal to all those throughout the Empire who watched so intently the struggle while it was in progress.

It should be read by all these, if only to quicken their memory of the exploits of which it tells and of the heroism and endurance which went to make these exploits possible. Unfortunately the price at which the volume is published (one guinea, and the maps a guinea more) must inevitably place it beyond the reach of many who should and would desire to read it, and it is much to be regretted that it has not been possible to forgo a portion of what must surely be a very substantial monetary profit on each volume sold. The gain by doing so might not be capable of financial expression, but the effect morally would be of inestimable advantage, and there is nothing that the book itself proves more clearly than the reality of moral values.

The volume opens with a very clear preface in which is set out the purpose of the history and the general arrangement of the matter. It is essential to a proper understanding and appreciation of its contents that this preface should be read. Its contents will be briefly referred to, as illustrating the scope of the book. The period covered extends from mobilization to the middle of October, that is until the transference of the Expeditionary Force from the Aisne to Flanders. It includes, therefore, Mons, Le Cateau, the retreat, the advance, the Marne, and the Aisne, and leaves the first battle of Ypres to be dealt with in a later volume. Even thus limited the history of this period occupies, with appendices, over five hundred pages, dealing as it does with the doings of squadrons, batteries, and companies. It is obvious that though this may be possible in regard to 1914, when at first only four and later six divisions were engaged, it will be impossible to adhere to such a scale in the record of later events. The reasons guiding the author in this matter are best given in his own words. He says:

> 'For this volume the scale adopted seems appropriate, in view of the importance of small units in the early operations, of the lessons to be derived from the study of the work of these units in open warfare, and of the desirability of leaving a picture of what war was like in 1914, when trained soldiers were still of

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greater importance than material, and gas, tanks, long-range guns, creeping barrages and the participation of aircraft in ground fighting were unknown."

With these reasons it is probable that most readers will agree.

The history is based on the British official records, which embrace not only the war diaries of every staff and unit engaged—and the extent of these can be estimated by any of the numerous officers who had to do with their preparation—but also the General Headquarters files, the Commander in Chief's diary, and practically every telegram and message despatched and received. These again have been supplemented by private diaries and papers and by interviews. The difficulty of selection must have been immense, and greater even than the difficulty of selection must have been the task of reconciling apparently contradictory records and recollections. How greatly these differ will be appreciated by anyone who has had to attempt an accurate and and impartial account of anything which happened on a battlefield only a short time after its occurrence. To the above sources of information must be added records, official, semi-official, and private, of French, Belgian, and German origin, including very numerous books published in those languages, to which frequent reference is made, and of which a list is given.

The devices used by the author to help to an easy comprehension of the narrative are just those that any reader of other war histories will generally have found absent, and are probably founded on his own experience as a student. For instance the titles of German formations and units are printed in italics; the dates of the events to which each page refers are given in the margin; reference is also made there in each case to the appropriate map; numerous explanatory foot-notes are added; and cross references are frequent. Besides the separate volume of maps small sketch maps are included in the text as an aid to the general reader, and are often sufficient to obviate the necessity of reference to the separate maps in following strategical operations. Directive and operation orders, orders of battle, and certain important correspondence have been relegated to appendices where they are given in full. In fact every detail seems to have been thought out for the convenience of the reader.

The narrative matter opens with an introduction treating shortly of the organization, and to some extent of the history, of the opposing armies, and thereafter is divided into chapters each dealing with a definite action or situation and its linked events. Chapters are further subdivided into sections, each complete in itself as a narratve of the matters or events to which it refers, and there is added to each chapter an account of the German contemporary situation or action as it afterwards became known from German records. Reference is also made as necessary to the action of our Allies where this enters into or affects that of our own troops. In the opening chapter a very brief notice is given of the political events leading up to the war, but for a full account of these the reader is referred to Sir Charles Oman's "The Outbreak of the War 1914—1918" published by H.M. Stationery Office.

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In the course of the narrative the historian has occasionally to deal with matters which have been the subject of somewhat bitter personal or national controversy. These are handled with admirable discretion, and while facts are impartially, and it may almost be said ruthlessly, recorded the reader is left to form his own judgment, which in most cases will be found to present little difficulty.

In illustration of the author's treatment of his subject it may be permissible here to give a few extracts from the text, but before doing so it may be of interest to quote a passage from Lord Kitchener's Instructions to Sir John French before taking the field. As a prelude to the operations which followed, and as a key to certain decisions taken, it is worthy of remembrance. The Secretary of State for War says:

> "It must be recognized from the outset that the numerical strength of the British Force and its contingent reinforcement is strictly limited, and with this consideraton kept steadily in view it will be obvious that the greatest care must be exercised towards a minimum of losses and wastage. Therefore while every effort must be made to coincide most sympathetically with the plans and wishes of our Ally the gravest consideration will devolve upon you as to participation in forward movements where large bodies of French troops are not engaged, and where your force may be unduly exposed to attack. . . . In minor operations you should be careful that your subordinates understand that risk of serious losses should only be taken where such risk is authoritatively considered to be commensurate with the object in view."

Here is a picture from the early days of the retreat—

> "Our troops were still confident that, when on anything like equal terms, they were more than a match for their opponents; the one trouble that really oppressed them was want of sleep. Long after nightfall the battalions of the 3rd Division were passing the cross-roads at Bavai, the men stumbling along more like ghosts than living soldiers, unconscious of everything about them, but still moving under the magic influence of discipline and regimental pride. Marching, they were hardly awake; halted, whether sitting or standing they were instantly asleep."

Here is another from the records of a battalion commander—

> "We had marched 59 miles in the last 64 hours, beginning the march in the middle of an entirely sleepless night, and getting only 8 hours altogether during the other two nights. Many men could hardly put one leg before another, yet they all marched in singing. The other battalions of the brigade did not arrive till long after dark, but they also marched in singing."

And these were men of an army which had passively but stubbornly resisted all well-intentioned efforts to make it sing on comfortable peace manœuvres!

The following message from the gallant Major Charrier, commanding the ill-fated Munsters, on 27th August, the day they were cut off

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on rear guard and practically the whole battalion lost, clearly exemplifies the fighting spirit of the force—

> "Am holding on to position north of Fesmy village, being attacked by force of all arms. Getting on well. The Germans are driving cattle in front of them up to us for cover. We are killing plenty of them."

The account of the battle of Le Cateau is stirring in the extreme; quotation cannot do adequate justice to it, so full is it of thrilling and glorious episodes. The historian sums up the action in these words—

> "The whole of Smith-Dorrien's troops had done what was though to be impossible. With both flanks more or less in the air they had turned upon an enemy of at least twice their strength; had struck him hard and had withdrawn, except on the right front of the 5th Division, practically without interference, with neither flank enveloped, having suffered losses certainly severe, but considering the circumstances, by no means extravagant. The men looked upon themselves as victors; some indeed doubted whether they had been in a serious action, yet they had inflicted on the enemy casualties which are believed to have been out of all proportion to their own."

It may be news to some that Le Cateau was fought on the anniversary of Crécy. Allowing for the changes in method of war brought about in the passage of over five centuries, the similarity in the two actions, their result, and the influences by which this result was brought about are most striking. In both cases an army in a desperate situation in retreat turned on its pursuer, and by the skilful use of its weapons, whether bows, pikes, guns, rifles, or bayonets, backed by the stout hearts behind them, snatched almost unhoped for victory.

Of especial interest to us Gunners are the frequent references to the good work of the artillery. A glance at the index, under the heading "Artillery", exemplifies well the significance of our motto "Ubique". It is difficult to select instances for especial notice where so many noteworthy deeds are recorded. But mention may be made of a few; of the guns of the 6th Battery at Mons, disposed in a semicircle near Bois la Haut against an enveloping enemy a few hundred yards away; of the 23rd Battery at the same place, waylaid in retirement by German infantry behind a barricade at a few yards range, the leading team and drivers shot down, and the battery saved by the help of the gunners with their rifles, and finally extricated with the Germans three hundred yards away. It is dramatically told how "L" Battery at Quiévrain "had the chance for which every gunner prays", and how they took advantage of it,—

> "No sooner did the Germans show themselves than it opened upon them with shrapnel, bursting its shells low, with an accuracy which literally mowed down the advancing masses. In vain they ran back to cover, rallied, and endeavoured to press forward. In vain four German batteries, three firing shrapnel and one high

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explosive, strove to silence the exasperating guns which were arresting the progress of the infantry. . . . . "L" Battery was not to be silenced, and forbade, under heavy penalty, any hostile advance from Quiévrain."

And of 'L' again at Nery, caught in the misty dawn of the 1st September limbered up with poles down it is told how after all guns but one had been disabled, and every officer killed or wounded, the survivors (there were only two or three, and nearly all wounded) "continued to fire until the last round was expended and then—but not till then—'L' Battery was silent."

The story of Le Cateau is full of the deeds of the artillery. its tenacity, self sacrifice, and hard hitting. Here is an example from one of the hottest corners of the battle line.

"Meanwhile the German battalions were steadily gaining ground; in fact as the last gun team of the 5th Divisional Artillery was driving off . . . . they were only four hundred yards from it, and were only kept back for a time by a party of the Manchesters, which with the machine gun detachment offered so stout a resistance as to gain a few minutes respite. During this brief interval Captain Reynolds of the 37th Battery, having obtained permission to call for volunteers, came galloping down with teams to rescue the two howitzers which had been left on the ground. The German infantry were then within two hundred yards, yet by the gallantry and devotion of this little party both howitzers were limbered up; and though one gun team was shot down before it could move the other galloped off with its howitzer and brought it safely away."

The action of Crépy en Valois on 1st September furnishes a fine example of artillery rear guard work, and shows what guns well and boldly handled can do in close support of infantry. The West Kents, rearguard to the 5th Division, were seriously attacked just as the Division began to move. They

"were supported by a section of the 119th Battery which came into action within one hundred yards of the firing line, opened at fourteen hundred yards range, and firing one hundred and fifty rounds in five minutes brought the Germans to a standstill."

But there must be an end to these quotations, though temptation to multiply them is felt as every page is turned. Looking back on one's own recollection of those great days, freshened as it is by the perusal of General Edmonds moving story, one is tempted to ask oneself what new lesson in war these experiences, so dearly bought, have taught us. The price, heaven knows, was high enough. Have we gained knowledge worth the cost? Yes, and no. New lessons—none. But over and over again the old truths of war, the same through all ages, but so often lost sight of in peace, have been hammered into us. Prominent among them is the proof, again and again repeated, that three essential requirements go to the making of victory. Where these are found ultimate defeat need never be feared.

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The first is discipline. Not the discipline of sterness and fear, which some armies have relied on, but the true discipline which springs from comradeship; from a common pride in the regiment; from confidence in and respect and affection for leaders, the companions of their men's sports and recreations; from a firmly rooted conviction that never will the officer let his men down.

The second is skill with the weapon. Such skill as gave confidence to our cavalry in their charges, and enabled them invariably to bear down their opponents. Such skill as made our artillery a terror to their enemies as long as ammunition lasted, even outclassed as they were in calibre by many German guns. Such skill as made the rifle fire of our infantry so deadly and irresistible that their opponents declined to believe that it did not proceed from scores of machine guns. It is skill of this kind that gives a soldier the confidence in himself and his comrades which alone is almost enough to carry him to victory.

And lastly tenacity, which in its essence is simply the gift of retaining the other two qualities through long continued hardship, privation, and danger, of keeping the stout heart and cheerful outlook which refuse to regard defeat as possible. This—and we cannot be too thankful for it—is a quality that our army has never lacked.

It is impossible not to yield to the temptation to end this review with one final quotation. It is taken from the last page of the book.

> "The British Army gained much useful experience on the Aisne, and absolute confidence in its shooting . . . the soldiers astonished even those who had trained them by their staunchness, their patience, their indomitable cheerfulness under incessant hardship, and, in spite of a fire which no human being had ever before experienced, by their calm cool courage at all times. Whether it was the gunner unloading ammunition almost too hot to handle, in the midst of blazing wagons; the engineer repairing his bridge under continuous fire; the infantryman patiently enduring heavy shell-fire, patrolling No-mans-land in the hours of darkness, or, as sniper, lying all night on soaking clay in dripping beet-fields; the transport driver guiding his wagon through bursting shells; or the stretcher-bearer toiling through the dark hours to rescue the wounded; all alike proved themselves worthy soldiers of the King. Though their dearest friends, comrades of many years, fell beside them, they fought with the majesty of their ancestors, without anger or malice, trusting always in the good cause of their country. There could be no fear as to the final victory if only armies of such soldiers could be brought into being in sufficient numbers without delay, and conveyed in security across the Channel to France."

There was no fear—in the Army at any rate. And it was on the courage and devotion of which this book tells that confidence was grounded.

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GOLD MEDAL PRIZE ESSAY

BY MAJOR H. G. MARTIN, D.S.O., O.B.E., R.F.A.

"INDIA AND THE NEXT WAR."

"There is but one art—to omit!.....A man who knew how to omit would make an Iliad of a daily paper....."

R. L. Stevenson's Letters.

Reprinted from Journal of the United Service Institution of India, October, 1922.

Part I.—The Probable Nature of Future War.

"WAR" is a general term, and a discussion of the subject applicable —let us say—to a frontier expedition would be manifestly inadequate to another cataclysm such as that of 1914-18; so the all-important question arises at the outset: with what manner of war have we to deal? Obviously, then, our first task must be to consider the probable nature of India's future wars. These we may class generically in four categories :—

(1). Limited Indian campaigns.
(2). Unlimited Empire-war, *ex*-India.
(3). Unlimited war in India, and on her borders.
(4). A combination of (2) and (3) above.

(1). *Limited Indian campaigns.*—A campaign in this category may vary in magnitude from a punitive operation in Malabar to a war forced upon us in Afghanistan. Such warfare, it must be understood, is to be regarded as "limited" *from our stand-point only*, and will retain its character as such precisely to the extent that the trouble remains localized; on the part of the enemy, on the contrary, his military efforts must generally amount to unlimited war from the outset.

The conduct of such operations is of course essentially the responsibility of India; and her forces will form the spear-head though the blow may be thrust home with help from overseas. Now, in India's present situation, initial reverses or an unduly deferred offensive may well be cause sufficient to extend the scope of a limited campaign till it attains the dimensions of unlimited war. Hence, above all else, our first essential is here that perfect co-ordination of policy and strategy which, as we all know, alone permits the initiative to be seized and relentless pressure to be maintained until decisive success has been

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won. But the most cursory survey of our past Indian campaigns—notably the successive Afghan wars—makes it only too apparent that it is precisely this co-ordination that has been, on occasion conspicuously lacking in our councils. And the future outlook in this respect is even more anxious. As a result of the Reforms, the Government is now in a permanent minority in the Legislative Assembly; and, though Defence is still a reserved subject, the experience of the past session shows clearly the extent to which that body can bring indirect pressure to bear. Nor will the position improve until racial antipathy has decreased; and politician and electorate alike have been educated in the true meaning of Defence, and in the military value of a martial, as opposed to a non-martial, race.

To sum up: if our strategy is permitted to keep pace with our policy, a limited war of this nature need present no serious difficulties—as long as it remains an isolated operation; on the other hand, as a grievous addition to our burden in an unlimited war, the minor campaign will at once assume the character of the major commitment.

(2). *Unlimited Empire-war,* ex-*India.*—With the conclusion of the late war, the centre of gravity of the Empire moved from the North Sea to the Western Pacific. Therefore, since the discussion of a concrete case must always carry more conviction than abstract generalities, we propose briefly to consider the Pacific problem as a source of future war.[1] According to a prominent school of thought in England, Russia, and the United States, Japan has used the Anglo-Japanese Alliance to enable her successively to eliminate Russia and Germany from the Western Pacific; and the Washington Conference, while it has lessened the burden of naval armaments, has yet left racial ideals, racial antagonisms, and the relative strengths of the rival navies, unchanged. On grounds both geographical and ethnical Japan still holds herself entitled to a preferential treatment in the Chinese market amounting to monopoly; her surplus population still demands an outlet for expansion unretarded by the competition of low grade labour which it encounters in China and Korea; and, as a means to fulfilling these ideals, the hegemony of the Western Pacific has been, and still is, her goal. True, the signature of the "Four Power Treaty" seems to preclude war for the next ten years; but the recent history of such treaties is not convincing, and ten years is at best but a moment in the evolution of nations.

Such, then, are the arguments of this school. If these arguments are sound, the problem is this: at her appointed time shall we acquiesce in Japan's claim to the hegemony of the Western Pacific, with all that this hegemony must imply;[2] or shall we fight? That of course is a question of policy for the statesman to decide. But, if we are to fight, it is clear that the communications of our fleet must stretch forward

[1] For the most up-to-date discussion of the problem see "The Problem of the Pacific in the XXth Century" by GOLOVIN and BUBNOV.

[2] "Australasia is nearly as large as Europe, while its population is less than that of the City of London. Surrounding Australasia are Asian empires with a population approximately ten times greater than that of Europe."—"*The Day of the Saxon*" by Homer Lea.

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through Bombay and Colombo to Singapore and Hong Kong, while India herself must be organized as a vast advanced base for our armies. In such a war, an actual invasion of India from overseas is inconceivable; so, if the local situation permits, all her resources will be concentrated on the assistance of the Empire in external theatres. Therefore, though India's army is primarily maintained for India's needs, no military organization can be complete that does not contemplate possible expansion in co-operation with the Empire's forces overseas; while—economically—not only must every effort be made to render India self-supporting, but her vast natural resources must be developed until they constitute an actual source of munitions and supplies proportionate to her potential wealth.[1]

To carry out this rôle it is obvious that peace on her borders and an absence of internal unrest are India's two prime essentials; for on these two factors must directly depend the scope of the assistance, both military and economic, which she will be in a position to render. It must be apparent, therefore, that in time of peace we cannot afford either to ignore our local enemies or to experiment upon them with the panaceas of political visionaries; it is our bounden duty to put our house thoroughly in order during the ten years' respite that we are promised before the Empire may again find itself engaged in unlimited war.

(3). *Unlimited war in India, and on her borders.*—For us here in India to-day what are the particular storm-clouds that the future may hold in store? It is difficult to foresee; for Asia is in the melting-pot from Angora to Pekin. The following facts, however, are sufficiently clear. Russia is bankrupt, and machinery for the transportation and maintenance of her armies is almost wholly lacking, while—from beyond the Oxus—come rumours of a nationalist movement which bids fair to throw back the Bolshevist from Turkistan.[2] Further, largely owing to the treaties of Kars and Angora and to the Greek failure at Sakaria, the nationalists are to-day the only real power in Turkey. Consequently, though Russia must ultimately recover—and, organized and officered by Germans, her recovery may well be rapid—the immediate future in Central Asia and the Middle East would appear to lie at least as much with Islamic pan-nationalism as with Bolshevism. It is certainly conceivable, therefore, that sooner or later we may find ourselves confronted by an Islamic confederacy stretching from Kabul to the Bosphorus.

If, in the alternative event, the future lies with Russia, we can safely assume that, whatever form her Government may take, its policy in regard to the Indian hinterland will pursue the traditional Russian lines of penetration and expansion. Nor is subversive propaganda in India likely to diminish with the nearer approach of Russia to our frontiers.

[1] For India's economic possibilities and present limitations see the "Report of the India Industrial Commission, 1916-18," the Industrial Handbook, 1919, Indian Munitions Board."

[2] The above was written before the collapse of ENVER'S rebellion.

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Hence we see that in the not-distant future we may be faced either by a reorganized and inherently hostile Russia, or else by an Islamic confederacy so situated that it can threaten the frontiers both of Mesopotamia and of India while exercising the profoundest influence over its co-religionists in these countries.

Now, in the event of war to the North, our military requirements are perfectly clear. We must be in a position to ensure the rapid mobilization and deployment of our field army together with the uninterrupted functioning of the State; while reducing the calls on covering, and internal security, troops to a minimum. How does the present situation meet these requirements? We are obliged to continue an extravagant allotment of troops to internal security duties. And of these troops the proportion of the more expensive British article is necessarily high, so the system is doubly wasteful of man-power and money. Further, owing to the improved armament of the tribes, we are obliged to maintain a covering force approximately equal to the infantry strength of our entire field army. And, since this covering force forms no part of our striking force in major operations, the first principles of strategy are violated by the allotment of so large a proportion of our troops to a role which is primarily passive. Finally, our communications in rear of the forward concentration-areas of the field army will be exposed to flank attack in war. Hence the conclusion is again forced upon us that, during the present interlude, we literally cannot afford either to nurse sedition or to tolerate the presence of a numerous and well-armed enemy in our tribal territory. Our policy should be such as to ensure that these hostile elements are either reconciled or—should that prove impossible—then rendered thoroughly innocuous, while our whole military resources are still available to give effect to our policy if need be.

But we have seen further that, owing to the advent of the Pacific Problem, the retention of India is to-day strategically more vital to the Empire than ever in the past. Therefore a struggle for our survival in India can be nothing less than unlimited Empire-war; for, though the initial responsibility will still rest with India's army and executive, ultimately our position must be maintained by all the resources of the Empire.

We are thus brought face to face with the principle that the defence of any vital portion of the Empire is the equal concern of all its component parts. And this principle obviously demands not only a thorough co-ordination of Imperial policy but also an equally thorough co-ordination of Imperial defence, in order that combined military effect may be given to our considered policy in the last resort.[1]

[1] A propos of policy it is interesting to note that France has lately found it expedient to sign the treaty of Angora primarily in order to consolidate her position with her Mussalman subjects in Tunis, Algeria, and Morocco. The expediency of an entente with Angora is even more obvious in our case.

For a discussion of the means to attain this co-ordination of policy and defence see "*Defence of the British Empire*" in the "Army Quarterly" January, 1921, and also the "*Report of the Army in India Committee*" (Introduction and Part I).

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(4). *A combination of* (2) *and* (3) *above.*—By this we mean an attack on our land-frontier, possibly in combination with internal revolt: the whole aimed at our eviction from India at a time when the Empire's whole resources are already engaged in unlimited war. The point to note here is that, in a crisis of this nature, any local operation which we are obliged to undertake can no longer be treated as "limited", but must be regarded as an extension of our battle-front in the major war, a front defeat on any part of which may be fatal to us. We know, too, that to Lenin and others of his kidney, India represents the "Achilles' heel" of the British Empire, his arch enemy; so, in the event of war in almost any quarter of the globe, it requires little effort of imagination to picture the influences that will be at work in an endeavour to oust us from India. Hence we find still further cause to emphasize the conclusions to which we have already arrived in our discussion of (3) above.

Part II.—The Financial Aspect.

We have now completed our survey of the various natures of campaign in which India may find herself engaged. But, since policy and strategy alike are rigidly controlled by financial limitations, a short *resumé* of our financial position is a necessary prelude to our discussion of Indian defence in its relation to these future wars. Briefly the position is this:—

The net expenditure of the Central Government for the current year is estimated at about 106 crores; and of these, 62·18 crores or about 60 per cent. of current expenditure, are allotted to defence. Hence it would at first appear that the proportion of revenue thus allotted is so unjustifiably large that the normal functions of the State must be crippled, and its economic development seriously retarded.

There are, however, other important factors in the problem which cannot be overlooked. Firstly, we must not omit the provincial budgets from our calculations and, working on this basis, we find that in reality only some 26% of India's total expenditure is allotted to defence.

Secondly, while India is poor she is also probably by far the most lightly taxed country in the civilized world.[1] But India is unfortunately unique in yet another respect, in that expenditure is here regulated by the budget, as opposed to the elsewhere-universal system of budgeting for essential expenditure. Hence defence, which is notoriously nothing more or less than indispensable insurance, has had to suffer. But we have already brought our insurance so dangerously low that, in present circumstances, further reduction would be criminal folly.

At this point, it is instructive to note that those who are most insistent in their demands for a reduction in military expenditure are generally the very people who clamour either for Swaraj or at least for

[1] In Great Britain taxation and public debt now amount to £22 and £200 per head respectively; in India to 9*d.* and 21*s.*

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the immediate grant to India of complete Dominion status. But they conveniently ignore the necessary corollary to either of these consummations. India's present military expenditure amounts to 2s. 6d. per head of the population. Now Swaraj, or complete independence, would entail the maintenance by India of forces, naval, military, and air, adequate to meeting all her needs; and these, in the light of history and the present position in Asia, are not likely to be small. To take an instance: Japan, a comparatively poor Asiatic power, found it necessary to spend 7*s*. 5*d*. per head on defence in 1913-14; and, since the costing charges of an army or navy are $2\frac{1}{4}$ times as great now as they were then the maintenance of similar forces to-day would cost 16*s*. 8*d*. per head, or about seven times the rate per head that India is at present paying. Obviously then, in this quarter lies no relief.[1]

In the second alternative, India can hardly deny that her co-partners in the British Commonwealth would be fully justified in demanding that she should accept her fair share in the common burden of the Imperial defence, in return for her admission on equal terms; but defence is costing 75*s*. per head in Great Britain to-day; in India 2s. 6d.; so in this quarter too the outlook for reduction is equally discouraging.

We are in fact involved in a vicious circle. Light taxation, with its natural concomitants—a contented people, and more money available for economic expansion—are *primary military essentials*; so, in view of universal trade-depression and of the deficits in both the central and provincial budgets, the soldier is the first to admit that reduction in military expenditure is most desirable. But it is the duty of the army to provide for the safety of the frontier and for internal security. Nor is reduction in these quarters possible until the Central Asian situation has crystallized and the border problem has been solved, and internal unrest has decreased; while it is precisely this internal unrest which accounts to a large extent for the failure of revenue to meet budget requirements.[2]

Hence the solution of the difficulty lies not so much in a precipitate reduction of the army as in the eradication of those root-evils which at once render the present military expenditure unavoidable and our means to meet that expenditure inadequate. On economic grounds no less than on strategical, the abatement of unrest and the solution of the border-problem are alike essential preliminaries to a reorganization of Indian defence on sound and economical lines.

Part III.—Our preparations for future wars.

From the preceding discussion we arrive at the conclusion that the ideal process of evolution is the following:—

[1] See "*India at the Cross-roads*," "Army Quarterly" October, 1920.

[2] In the past year, the loss of central revenue directly attributable to non-co-operation has been estimated at 15 crores: the indirect loss due to unrest generally, through restriction of trade and the reluctance of capital to embark in fresh ventures is incalculable.

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(1). The abatement of unrest, concurrent with :—
(2). A solution of the border-problem.
(3). Dependent on, and subsequent to, the above, the utilization of our period of grace from major wars for :—

(*a*) The reorganization of Indian defence on a basis which will permit of immediate retrenchment whilst affording facilities for large expansion in case of a major war in the future.

(*b*) The economic development of India.

(1). *The abatement of unrest.*

Indian unrest, as a symptom of the world-wide spirit of self-determination due to the reflex of the war, can be allayed most readily by our present policy—that of sympathetic and progressive recognition of India's legitimate aspirations in so far as these are consistent with the national safety. Responsibility breeds moderation; and we can fairly hope that with increasing responsibility will be born a sense of true Indian nationalism in its wider aspect—a nationalism which will appreciate the benefits that accrue from continued participation in the British Commonwealth and which will view the problem of defence with a saner and more instructed outlook. At best, however, this educational cure must be a slow and laborious process; while now, unfortunately, the cure is wholly counteracted by the poison which the professional sedition-monger sedulously administers to the body politic. It is of course no part of the soldier's duty to attempt to influence the policy of Government in coping with sedition. But the lesson to be learnt from the contrasted course of recent events in Ireland and South Africa need not be laboured: a policy of some kind or other there must be.

In any case, though it is our declared intention to make of India a self-governing Dominion voluntarily co-operating with the other free nations of the Empire for the common good, the hard fact still remains that the retention of India, voluntary or involuntary, is a necessity vital to the Empire: a fact fully realized by Australia with her white population of five and a half millions face to face with a thousand million Asiatics. Hence, come what may, India will remain within the Empire; a conclusion which, if its truth were universally recognized, would go far to discourage sedition.

(2). *The border-problem.*

The present situation on the North West Frontier is directly attributable to the "Curzon" policy of non-interference inaugurated in 1898. The success or failure of this policy must be judged by results.[1] Since 1898, subsidies have only bred fresh subsidies: and repeated expeditions entailing heavy expenditure and casualties have been unavoidable. Further, that the situation shews no signs of present improvement the attitude of the tribes in the 3rd Afghan war

[1] For a detailed discussion, see the Chief Commissioner of the N.W.F. Province's Despatch of August, 1919.

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and the recent history of Waziristan alike go to prove; while, south of the Kabul River, raiding is still rife everywhere. As an business proposition, then, the policy must be said definitely to have failed.

Now, in its purely military aspect, the border-problem presents no insuperable difficulties. The source of tribal unrest is primarily economic; while the tribes rely against us mainly on the difficulties of their country, and on their safe line of retreat into Afghanistan in emergency. Hence, if roads and railways could be built and our troops could permanently occupy strategic points whence they could threaten the tribesmen *from the rear* and strike on the first hint of trouble, not only should we have removed the source of unrest by providing a living wage for honest work, but at the same time we should have deprived the tribes of their two chief weapons against us. And, as their stake in the country grew, so would their reluctance to run any risk of losing it. In all human probability, therefore, it would ultimately be possible to hold this territory with greatly reduced forces. But, while every soldier whose business it is to study the frontier doubtless knows the roads and railways to be built and the strategic points to be occupied, and though the advantages which would accrue therefrom can hardly be gainsaid, the present situation must be indefinitely prolonged because the necessary funds are not forthcoming from revenue to rectify it. To meet this difficulty, then, the following proposal is put forward for consideration. An estimate should be made of the total initial cost of a permanent settlement of the border on the above lines, the estimate to include the cost of military operations and of roads, railways, and building; and a loan should then be raised, thus capitalizing the cost. Now a loan to be financially justifiable must offer returns either direct *or indirect*; what returns have we here to offer?

During the past five years, military operations on the border have cost us enormous sums, and we are no nearer a settlement: the additional lump-sum for the scheme we suggest would amount to perhaps 50 per cent. of the past five years' expenditure—with the certainty of a very large and *permanent* annual saving for the future. The indirect returns are patent enough surely; and we believe that a large section of the Indian public would fully sympathize with the object of such a loan and would support it.

(3). *Proposals for ultimate reorganization.*

We shall now make two bold assumptions, *viz*: that the internal situation has so improved and the border become so stabilized that large military reorganization and retrenchment have become feasible, What lines, then, should this reorganization take? We suggest the following:—

(*i*). Reduction of the regular army.
(*ii*). Expansion of the Territorial Force.
(*iii*). Extensive Indianization of the officer-cadres of both regular army and Territorial Force, accompanied by dilution with British N.C.Os.
(*iv*). Improvement of equipment.

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(*i*). *Reorganization of the regular army.*

The immediate results of the assumptions which we make above are these: internal security, and covering, troops can be largely reduced; and we can be content with a considerably less degree of preparedness in our field army.[1] The redistribution of our regular forces might then be as follows :—

(*a*). *Covering Force.*—To consist of a comparatively small but highly specialized body of troops equipped with all the latest mechanical appliances of proved value; the force to be maintained at a peace establishment equal to its war establishment and first reinforcement.

(*b*). *Field Army.*—To consist of 2 divisions of regular troops *plus* the Territorial Army.

(*c*). *Internal Security Troops.*—To be reduced as far as the internal situation permits; their place being taken by a reorganized and efficient civil police.

All regular troops, *except* those of the Governing Force, should be reorganized on the European peace-basis, whereby units complete to war establishment with reservists on mobilization. At present the adoption of this vastly more economical system is impossible owing to the need for immediate preparedness, and to the unsettled state of India.

(*ii*). *Expansion of the Territorial Force.*

This force is cheap; and, on the analogy of the home organization before the war, we may expect it to expand to a strength of at least six divisions. All other considerations apart, this expansion is a political necessity—if we are to meet the legitimate demand of nationalist India to be fitted for self-defence. The force must receive sufficient training to enable it to take the field in two months from mobilization, and must be enrolled for *general service.* Training and divisional organization might well follow the system of Military Districts adopted by the Citizen Forces in Australia. A beginning should be made at once with specialist units, above all mechanical transport; for on general mobilization, the demand, for trained mechanical transport drivers, etc., will be enormous.

(*iii*). *Indianization and Dilution.*

Indianization, within certan wide limits, is a political necessity; and in time a supply of efficient Indian cadets will, we hope, be forthcoming from the Indian Sandhurst. The *raison d'tre* of the Viceroy's commissioned officer will then have largely disappeared. It is suggested, therefore, that his place in the regular army should then be taken by the British N.C.O. In favour of this highly iconoclastic proposal the following points are urged. All history goes to prove the superior-

[1] Because if the independent tribes are settled and disarmed, the enemy in event of a war to the North will be proportionately further off at the outset, and will have to fight his way through difficult country against the opposition of our covering troops deployed on, or near, the Durand Line.

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ity of the *average* white man as a leader; and, in the late war, the remarkable fighting value of the German askari in East Africa, the success of the French colonial troops in France,[1] and the enhanced efficiency of our Indian battalions in Allenby's final offensive, all were largely due to extensive dilution with white N.C.O.s. In future wars such N.C.O.s. would be worth their weight in gold as leaders generally, and as machine-gunners in particular; and, further, would be quite invaluable as a potential reserve of officers with Indian training. In peace they would act primarily as instructors: the system worked admirably for many years in John Company's army, and works equally well to-day in Ammunition Columns and Sapper and Miner units. Candidates for the cadre would of course, have to be selected with the greatest care; but, with this proviso, British and Indian should work together on the best of terms.

Turning now to the Territorial Force, we can fairly expect that, granted good instructors, the rank and file will become reasonably efficient in the near future. But no Territorial officers-class exists such as is to be found at home. Therefore, here again, the difficulty should be met by the institution of an adequate permanent cadre of British N.C.O. instructors to ensure sound instruction in peace and vigorous handling in war. This dilution is the more important as higher territorial formations will not contain the normal stiffening of British units. In addition, a regular commandng officer and adjutant must be seconded to each territorial unit for some time to come. But, apart from these two officers, it is recommended that all officers in the Territorial Force should hold Viceroy's commissions, on the analogy of the system in vogue in the Citizen Forces of Australia. These Viceroy's commissions should be given largely to suitable Indian ex-soldiers of the regular army on their joining the Territorial Force; for it is most desirable to keep a field of promotion open to the present type of Indian officer.

Finally, in regard to Territorial Commands and Staffs, we shall have to rely for many years to come on officers seconded from the regular army, and on the Reserve of officers, which latter is now being placed on a sound basis.

(*iv*). *Improvement of Equipment.*

Changes in organization having been thus briefly discussed, there still remains the question of equipment to be considered. Obviously, if we are to reduce our regular army to the extent above indicated, we must compensate as far as possible for loss of man-power by extended use of mechanical appliances. And proposed innovations should be thoroughly tested under local conditions before they are accepted. The formation of an Indian "experimental brigade" is, therefore, most desirable.

There is a school of thought, however, which goes much further than mere improvements in equipment: it advances the attractive

[1] A success so great that one-third of the post-war French army stationed in all theatres, including France, is to consist of Moslem North Africans.

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theory that the burden of our military commitments in sundry quarters of the globe can be enormously reduced by handing over to the Air Force and the Tank Corps the duties now carried out by the soldier.

(*a*) *Aircraft.*

The aircraft enthusiast bases his arguments in general on the results achieved by aircraft in the late war, but quotes in particular the dramatic extinction of the Mad Mullah in Somaliland in 1919. It is noteworthy that less copy has been made of subsequent incidents on the North West Frontier—such as the bombing of Kaniguram for instance. Now, in the late war, at least in France in the later stages, aircraft were available in almost unlimited quantities and objectives against which to employ them were never lacking; while the extinction of the Mullah in 1919 was due firstly to the fact that he was so totally ignorant of aircraft as to occupy a regular bomb-trap of a fort, and secondly, to the co-operation of mobile columns who finished him off once and for all— before he had had a chance of profiting by his lesson.

Acting alone, aircraft can influence the military situation only by their own offensive action—that is, by bombing and machine-gunning.[1] Now, even if we admit the experiency of indiscriminate bombing, it is clear that we must have an objective to bomb : and here we must remember that our most likely future enemies are neither highly organized, nor—like the Mullah—ignorant of aircraft. Further, we must have enough aircraft to do the job properly—it is so easy to forget the limitations of a squadron. To take as a typical instance a squadron of 2-seater reconnaissance and fighting machines such as are now in general use : the squadron has twelve machines; but under Indian conditions if we have eight of these machines simultaneously in action we are doing remarkably well. Each machine normally carries 250 lbs. of bombs and 1500 rounds of S.A.A. Therefore, allowing eight machines two flights a day—which is highly optimistic—we have a total of 4000 lbs. of bombs and 24,000 rounds a S.A.A. expendable by the squadron daily : approximately the weight of metal of a company of infantry and a section of 6″ howitzers—ignoring the fact that fire from the air must be infinitely less effective than fire from the ground. Hence it must be admitted that, if aircraft are to *replace* our land-forces, we shall require them in considerable quantities. But the flying life of a machine of the type we are considering is only 1000 hours,[2] and each machine costs £2,500; so shall we ever get enough of them, and—if we do—where is the economy? The conclusion is that, while aircraft are invaluable in their legitimate role as adjuncts to our land-forces, they are quite incapable of replacing them.

(*b*). *Tanks.*

The day may come when Colonel Fuller's dreams materialize, but that day is not yet. The mechanical limitations of the tank—and more

[1] Since the use of gas is absolutely precluded by our signature of the "Treaty . . . . to prevent use in war of Noxious gas and Chemicals," (Washington 1921).

[2] In France, in 1918, the wastage in aircraft from *fair wear and tear* was 51 per cent a month.

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especially of the tropical tank—are still very great. Further, when we consider the achievements of the tank in the late war, we must remember that, in mountain warfare against a semi-civilized or savage enemy—which is the form that our future operations must so often take—the conditions neither of objective nor of terrain will bear comparison with those existing, say, at Cambrai or at Hamel.

When a mechanically reliable fighting tank is produced, preferably a fast-moving cavalry machine, its utility under Indian conditions will of course be great. Meanwhile, in preparation for future wars against a numerically superior and highly mobile enemy with equipment inferior to our own, we cannot afford too considerable a sacrifice of man-power to obtain protected and concentrated fire-power the sustained mobility of which cannot be guaranteed.

(c). *Mechanical Transport.*

The attached table in the Appendix serves to emphasize two well-known facts: that the maintenance of a modern army without railway facilities is an impossibility; and that, if we are to have any radius of action from rail-head, we must rely mainly on mechanical transport.

Further, in order that railhead may keep up with our advance after the outbreak of war, we should in the first instance utilize the superior rate of *light railway* construction. And to do this, the necessary stocks of light railway material must be held at railhead in peace; since after mobilization delivery of material cannot fail to be delayed.

Beyond rail-head it is our object to have the maximum radius of action with the minimum road-space. The difficulty of maintaining trans-frontier roads under 3-ton lorry traffic is an insuperable objection to their extended use.[1] We come to the conclusion, therefore, that we should rely on 30-cwt. lorries augmented by van convoys for use in special rôles where the superior mobility of the latter is essential.

Now we cannot hope to maintain in peace more than a fraction of the lorries which we shall require in war; we must depend on civil resources. And it is obviously desirable that India should be self-contained in this respect. Subsidization of standardized lorries at first appears to be the obvious solution; but subsidization is an expensive business, and its pre-war results in England were not encouraging. It is suggested that, as an alternative, the import duty on satisfactory types of *English* lorries might be lowered, and arrangements made with the firms in question to standardize spare parts. In addition, the rules for the registration of motor-vehicles should be made more stringent; so that the civil authorities will always have an up-to-date census of all privately owned motor vehicles in each district to enable them to requisition at short notice.

But, to go further, there is a great opening in India for the carrier, as opposed to the fighting, tank; for a carrier tank such as the 3-ton pattern now under experiment at home, would be invaluable in a

[1] In France, 100 tons of metal per mile per fortnight were found necessary for the maintenance of roads under continuous heavy-lorry traffic.—Haig's Final Despatch.

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theatre where wheels cannot be used. In Waziristan, for instance, routes in nala-beds could usually be made practicable for carrier tanks merely by removing boulders higher than the track-clearance; and the advantages to be derived from their use by shortening road-space, lessening vulnerability, and simplifying the evacuation of wounded can hardly be overestimated.

Part IV.—Conclusion.

In the preceding pages some reference to politics and policy has been unavoidable, and it has been necessary to make some, perhaps bold, assumptions. Acting on these assumptions, we have tried to sketch a possible future reorganization of Indian defence. We shall now close on a note of warning. In matters of equipment and training by all means let us indulge in the most ruthless western efficiency: but let us remember, too, that the psychology of the East does not change. It is true that the organization of the Indian army to some extent broke down under the stress of the greatest war in history; but, before we wholly cast adrift from old established custom, we should ponder well the value of the assets which we may sacrifice thereby. His family traditions and his *izzat*, the personal touch of his officers and the amenities of the service, these have been the influences which have drawn the best of India's manhood into our ranks. If we voluntarily sacrifice these influences—verily is not our epitaph already written for us?

"And the end of the fight is a tombstone white,
With the name of the late deceased,
And the epitaph drear: 'A fool lies here
Who tried to hustle the East'."

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Appendix I.

Table to Illustrate the Relative Efficiency of Railway, Mechanical and Animal Transport as a means of maintaining an Army.

Notes:—*(i)* The figures are approximate only.

(ii) The force to be maintained is taken as 4 Divisions, for which the daily lift required is 900 Tons in the scale:—

Men	... ...	Full rations.
Animals	... ...	Half ,,
Ammunition	...	One-eighth echelon.

R.E. Stores in proportion.

Type.	No. required to lift 900 Tons.	Daily Radius (Miles).	Road Space (Miles).	Remarks.
(1) Broad Gauge Trains	1	—	—	Rate of construction beyond rail-head, 1 mile per day (maximum).
(2) Light Railway Trains	3	—	—	Rate of construction beyond rail-head, 2 miles per day.
(3) 3-ton Lorries	300	30	6	The passage of 50 heavy Lorries completely destroys even a good unmetalled road.
(4) 3-cwt. Lorries (pneumatic cord tyres).	600	40	16	A section of good unmetalled road will carry this traffic for a week.
(5) Ford Vans	2,500	50	42	Length of column excessive. Useful load small. Very extravagant in personnel, petrol, etc. *But* largely independent of roads in normal country.
(6) A.T. Carts	3,150	†10	13	*Thus, if the force is operating more than 10 miles from railhead, a second complete echelon of carts is required and so on. If the round trip is impracticable at any stage, the number of carts working on that stage must be doubled.
(7) Camels	45,000	10	63 (double banked) 126 (single file).	The same remarks apply as in (6) above. In addition, each stage added to the line reduces the useful load of camels working in the preceding stages, and increases the numbers required proportionately.

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GROUND FIRE AS A SPECIAL CASE OF A.A. FIRE.

A review of Lt.-Colonel E. Pagezy's article on this subject in *Revue d'Artillerie.*

BY MAJOR T. C. NEWTON, D.S.O., O.B.E., R.A.

THE October number of the *Revue d'Artillerie* publishes a most interesting article—Le Tir en l'air et son cas particulier le Tir à terre—by Lt.-Colonel Eugene Pagezy.

Colonel Pagezy is universally recognised as the world's foremost scientific A.A. gunner and anything from his pen is sure to be interesting. The article in question is written to appeal to gunners in general and not merely for A.A. gunners. It goes deeply only into those problems of A.A. fire which appear to shed a new or brighter light on the problem of gunnery on the flat and merely casts a rapid glance at those which apply solely to the air. Unlike some of Colonel Pagezy's writings, the article is entirely free from the higher mathematics and can be appreciated by those who, like the present writer, suffer from "mental deadtime" in that respect.

Colonel Pagezy indicates several particulars in which ground fire is a special case of A.A. fire. Thus—

In A.A. fire Height and Ground Range are co-ordinates of the same order of magnitude.

In ground fire the co-ordinate of height is very small compared with that of ground range—here we have a special case.

Again, in A.A. fire the target has an enormous speed of 50 yards a second or more, so that the point to hit, or future position, is as much as 2 kilometres away from the present position.

In ground fire the target is generally stationary or only moving at a snail's pace—another special case.

In A.A. fire, the point at which one fires is only of interest if the aeroplane presents itself there at the exact second when the shell arrives. It is a point of Einstein's "space-time." It has not three co-ordinates, but four. It is lost in the dark ocean of the four dimensions.

Ground fire can be considered strictly as three-dimension fire, but the element of height is so often non-existent that it becomes more

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exact to say that it crawls prosaically in two dimensions—again a special case.

The author then warns us to bear in mind constantly the special character of A.A. fire; that it is not just ordinary fire but fire on a hypothesis. We practically always assume that the aeroplane will maintain a constant speed and direction of flight during both the dead time (which elapses between the issue of orders and the firing of the gun) and the time of flight of the shell. In view of the considerable magnitude of these two periods, this assumption is quite gratuitous. All that can be said in its favour is that movement in a straight line, and more particularly in a horizontal straight line, occupies quite a special place among all the many possible kinds of movement. When an aeroplane has no warning that it is going to be fired at, when it is not trying to avoid fire by jinking, it follows the course most suitable for carrying out its task and this course is usually composed of long lines more or less straight and more or less horizontal, connected by curves of any convenient shape. Thus the ideal fire is to catch an aeroplane flagrante delicto, in the act of straight line, and if possible horizontal, movement and to let loose upon him brutally the simultaneous and carefully prepared rafales of a great number of guns.

There follows an interesting and amusing little discussion on determinism. Need we definitely make up our minds to this ignorance as to the future position? Does the future exist already? Will science ever permit us to read in "space-time" as we now read in the space of all the world? Will the factor of Time become just a co-ordinate like the others, as it already has in astronomy. Past or future matters little, the eclipses of 1950 are as well known as those of 1900.

Before replying to these questions, let us imagine a little being in only two dimensions, x and y. As time co-ordinate let us impose upon him not our co-ordinate t (Time) but our co-ordinate z (a space co-ordinate). This will give our infinitely flat little microbe a somewhat special existence rendering him worthy of a name—we wlll call him Omalos. Omalos, then, is a being in x and y who proceeds in space as we proceed in time. In proportion as his life goes by he makes the acquaintance of the successive series of surfaces by which the world can be intersected.

Let us hasten to add that x, y, and z are any co-ordinates whatever and our successive surfaces of constant z can take any form which pleases the imagination.

Compared to Omalos we play the part of Jupiter. We are, if not a god, at any rate a demi god, and with one single glance we take in what for him is the impenetrable future. Omalos raises altars and offers up burnt sacrifice to us.

But will our pigmy one day, armed with his memory and his logic, discover that future which to him appears unfathomable and which stares us in the face?

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At a particular moment Omalos realizes the actual state of his world, that is to say a certain surface of given constant z, and on the other hand he remembers all his previous states, that is to say all the previous "sections". From that moment when the surface of constant z crosses a body organized according to a certain law—a tree, a horse, a man,—Omalos triumphs, Omalos predicts the future; the trunk will be followed by branches, the branches by leaves; the shoulder will be followed by an arm, the arm by a fore-arm. Omalos has become an astromomer; Omalos is a determinist.

But when the surface crosses a heap of stones or the demolition area at Oxford Circus, all the logic and all the science of Omalos fall to the ground. His future remains determined but the prevision of that future remains forbidden to him.

We must not laugh too much at our little ignoramus. We are the Omalos's of a world in four dimensions. This world comprises a certain number of beings "organized" in every way, whose past conditions their future. They are the ones with which science is concerned. By dint of thinking only of these, many of our scientists come to imagine that space-time contains only organized beings and that is what causes many of them to be accused, quite wrongly, of lacking common sense in ordinary life. They forget the stone heaps and the demolitions. They tumble into holes while staring at the moon.

When we look up to watch an A.A. shoot let us try not to do as they do. Let us hold our tongues seven times before accusing our brother gunner of lack of skill. The changes of course of an aeroplane are part of that enormous sum of future events which disobey all laws, including the laws of chance. Doubtless they are determined in the sense that perhaps they are written somewhere in I know not what divine book. But they pass the bounds of our intelligence and they escape for all time the grasp of our logic and of our deductoins. They are at once determined and unforeseeable.

Chapter I. deals with fire at a stationary aerial target (neglecting wind, drift, and other corrections of the moment) and comprises four sections.

A.—A section on trajectories, curves of equal tangent elevation, curves of equal fuze-range, and curves of equal times of flight. (These curves will be alluded to as T.E. curves, fuze-range curves, and time of flight curves).

B.—A section dealing with the two problems of the tangent elevation and the fuze range.

C.—A section on semi-independent tangent elevation gear.

D.—A section on the "special case" of ground fire.

A. *Trajectories.*

In the case of ground fire there are two methods of reaching the target and both are made use of.

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By firing with a relatively small angle of elevation, usually less than 45°, we get a low trajectory.

We can also reach the same target with a relatively big angle of elevation, usually more than 45°, getting a high trajectory. In A.A. fire we have the same two alternatives, but we use only the shortest and most direct trajectory, that which arrives at the target before meeting the envelope.

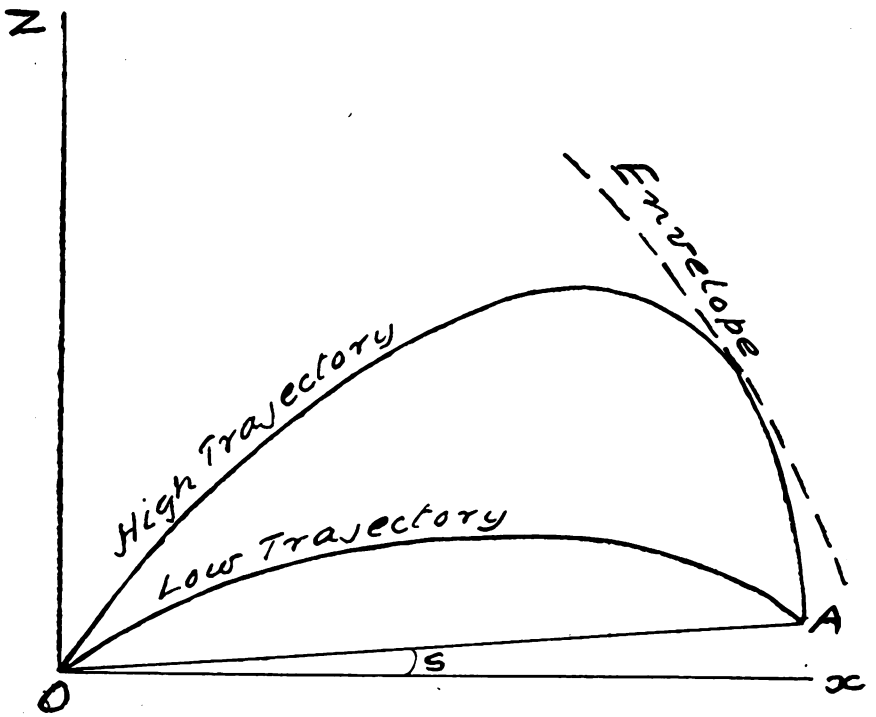

Fig. 1.

Those trajectories whose angle of departure is less than 45° reach the ground before they touch the envelope. They are useful throughout their length.

Those trajectories whose angle of departure is greater than 45° reach the envelope before they reach the ground. Only that part which is between the origin and the envelope is of use. Thus A.A. trajectories meet only at their point of departure. The angle of departure varies from 0° to 90°, but the problems of quadrant or tangent elevation have only one solution.

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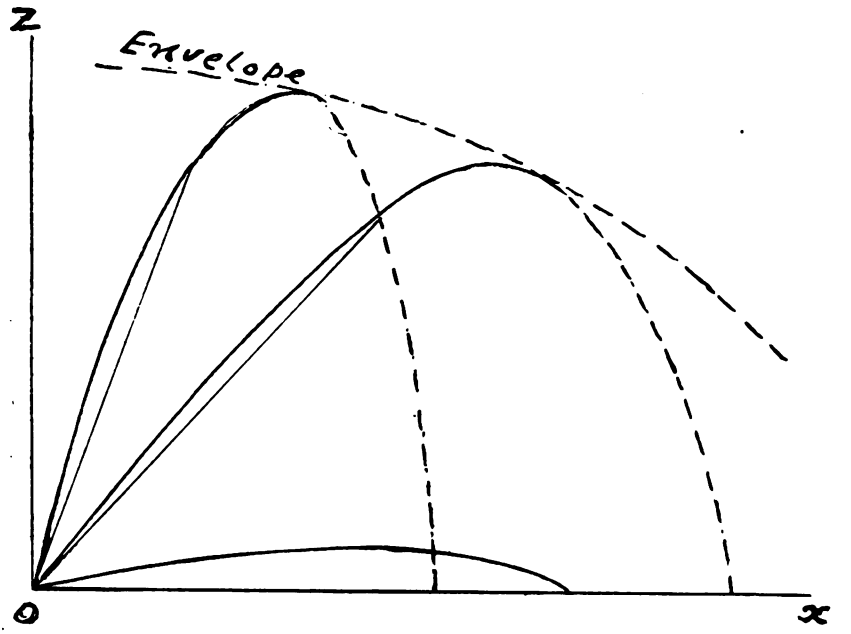

Fig. 2.

T.E. curves.

The T.E. curve B is the locus of the points to hit which the tangent elevation must always be B. In a vacuum the useless parts of the trajectories (i.e. those parts which lie beyond the point at which the trajectory meets the envelope) are the T.E. curves of the useful parts.

For a constant range along the line of sight, the tangent elevation almost always begins by increasing as the angle of sight increases. It reaches a maximum and then decreases to zero as the angle of sight becomes 90°.

For a constant horizontal range, the tangent elevation almost always varies in the same direction as the angle of sight; here we find again the old rule of ground fire—the correction to tangent elevation for angle of sight has the same sign as the angle of sight.

Fuze-range curves.

A fuze-range curve is the locus of all possible bursts of the same fuze setting fired at all angles of quadrant elevation.

The T.E. curves were deducible from the trajectories. Fuze-range curves cannot be deduced from trajectories, but it is as essential

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to know them as to know the trajectories. They are determined by ballisticians.

Fuzes are graduated in times, and it might be supposed that fuze range curves and time of flight curves were identical, but this is by no means the case. The time of burning depends not only on the fuze length but on its rate of burning, that is to say on the layers of air traversed (pressure, temperature, humidity) and on the manner in which the shell passes through them (remaining velocity, speed of rotation).

When the point of burst of a given fuze range is moved from angle of sight 0° to angle of sight 90°, the mean pressure of the atmospheric layers passed through constantly diminishes. The pressure being the preponderating influence, the fuze burns more and more slowly, with the result that the time of flight continually increases.

Shape of fuze curves.—At short ranges, the range in yards of a given fuze range increases constantly as the angle of sight increases from 0° to 90°.

At medium ranges, the range increases to a maximum and then decreases again.

At very long ranges, near the envelope, the range decreases continually.

On leaving the horizontal, and except at long ranges, the fuze range curve always starts by going outside the circle whose radius is the horizontal range, and outside the vertical tangent to this circle.

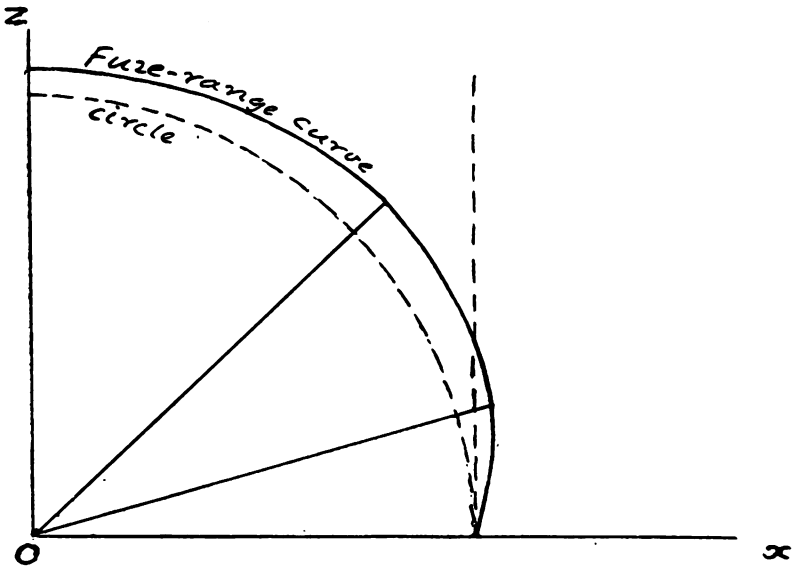

Fig. 3.

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Time of Flight curves.

In A.A. fire we fire at the "future position" as if it were stationary, but we must first of all determine the future position and this can only be done if we know the law connecting the time of flight with the co-ordinates of that position. This law is defined by the time of flight curves. In a vacuum the time of flight curve is a circle whose centre lies at a distance of $\frac{1}{2} g t^2$ vertically below the origin of the trajectories.

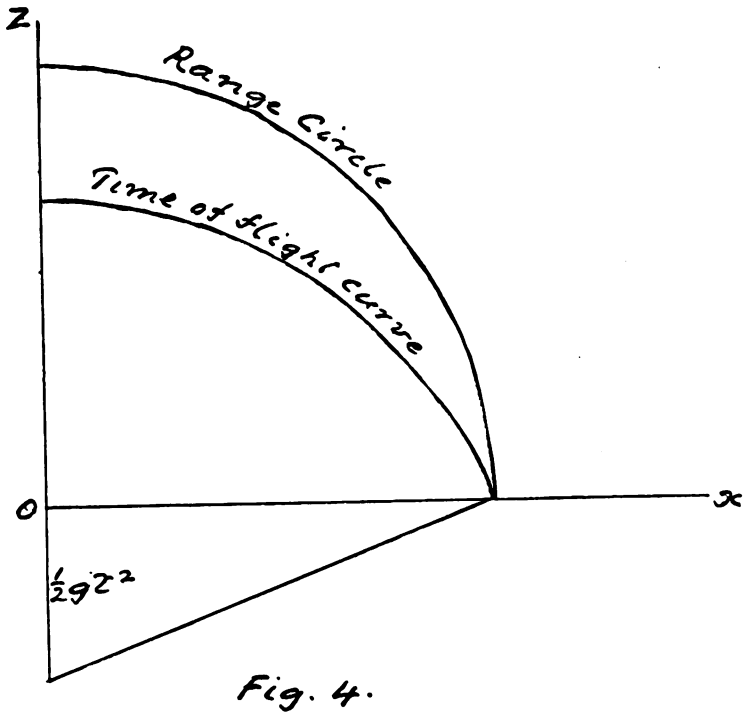

Fig. 4.

In the air the curve is very similar to a circle whose centre lies at a distance which is always less than $\frac{1}{2} g t^2$ vertically below the origin of the trajectories.

In both cases the curve lies wholly within the circle with centre at origin and radius equal to a constant range. Thus for a constant range the time of flight increases with the angle of sight. When we get mechanical fuzes, the fuze-range curves and time of flight curves will evidently coincide.

B.—The two problems of the tangent elevation and the fuze range.

The act of laying the gun applies the angle of sight, and for a given angle of sight the tangent elevation and the fuze-range are interdependent.

Suppose the fuze-range is known. For a given fuze-range there is a fuze-range curve which cuts the line of sight at a certain point.

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Through this point there also passes a certain T.E. curve which gives the tangent elevation we require.

In other words, tangent elevation is a function of the angle of sight and of the fuze-range; or T.E. $= f$ (S, F).

Thus if we can find a simple way of resolving this formula, the two problems of the tangent elevation and the fuze-range will become a single problem. Knowing the fuze range we shall deduce from it the tangent elevation.

We will show later how the fuze-range is found.

The formula T.E. $= f$ (S, F) is resolved by means of a regular calculating machine known as the tangent elevation dial, composed of:

(a) A dial which corresponds to the range dial of a field gun. On turning the T.E. handwheel the dial is turned through an angle proportionate to the tangent elevation.

(b) An index-pointer which moves across the face of the dial proportionately to the quadrant elevation.

On the face of the dial are inscribed curves of fuze range, and to give the tangent elevation for fuze-range F it is only necessary to turn the T.E. handwheel until the required curve comes opposite the pointer. (This alludes to a gun with independent tangent elevation. With the 3-inch 20 cwt. the gun must be re-layed). Whatever the movements of the gun may be the pointer automatically takes up the correct position on the face of the dial.

Note 1.—T.E. being obtained as a function of S and of F, if F is altered the burst merely displaces itself along the line of sight. In other words the tangent elevation dial ensures bursts on the line of sight (as far as correct tangent elevation is concerned) whatever the fuze range may be.

Note 2.—Calculating machines of the type of the fuze-range dial are of general utility for the resolution of formulæ of the type $z = f(x, y)$.

It is only necessary to rotate the dial according to some function of the variable x, to displace the index pointer according to some function of the variable y and then to read on suitable graduations the value of z. (More usually the index-pointer is moved according to some function of x and of y as in the case of the tangent elevation dial, where the pointer moves according to Q.E., i.e. S + T.E., where S represents y and T.E. represents x).

The curves on the dial depend of course on the function to be resolved and on the two functions of x and y according to which the dial and the index are displaced.

The machine is reversible and will give x as a function of z and of y, and y as a function of x and of z. To do this it is only necessary to graduate the circumference of the dial in x and the edge of the index-pointer in y.

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Determination of the fuze range. Height fuze indicator.

If the target were really stationary it would be natural to consider the fuze-range as a function of the true range and of the angle of sight. But we have to find the future position from the present position and we shall see later that this is made much simpler by replacing the co-ordinate of Range by the co-ordinate of Height. So the fuze range is considered as a function of Height and Angle of Sight; $F = f(H,S)$.

Angle of Sight is obtained by laying, and height is measured by instruments known as heightfinders, to be described later. H and S being known, the formula is resolved by means of an apparatus analogous to the tangent elevation dial and known as the height fuze indicator.

A plate is moved through an angle equal to the angle of sight.

A pointer is set along an arm proportionately to height. Curves of fuze range are inscribed on the plate, and the value of F (the fuze range) is read under the pointer. (This is the arrangement of the height fuze indicator of the 75-mm. auto-canon and remorque mountings).

(To be continued).

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OBSERVED AND UNOBSERVED ARTILLERY FIRE.

(Militär Wochenblatt, No. 21. 1922.)

BY LIEUT. P. G. E. WARBURTON, M.C., R.F.A.

HERMAN STEGEMANN, in his excellent book on the world war, in several places very justifiably describes position warfare as a deterioration of war. Following this idea, the army of to-day believes that the decision is to be sought for in moving warfare. This article is intended as a warning against the one-sided exaggeration of ideas which though right in themselves, cause errors if wrongly applied.

The year 1918 in the West appears to be the most important and interesting of the years of the war as material for instruction for the future. The war then began to free itself from the debased form of position warfare. The distinction between the fighting and passive fronts became sharper. The passive fronts no longer offered dependable flank-supports, they were broken through, and (viewing the front as a whole) sank to the rôle of a, certainly very strong, frontier defence. The great German offensive successes were opened by unobserved artillery fire. Once the fighting became mobile, unobserved artillery fire was, it is true, limited to isolated smaller formations, batteries and groups, e.g., in the fighting in October 1918 in Flanders, where observation was impossible. One of the keys to understanding those battles is the fact that, after a successful break-through, a second artillery deployment against enemy positions, which were capable of resistance, met with difficulties everywhere. The tank and the aerial battle squadron using machine-guns had the most influence in giving a new note to the year 1918.

If one pictures to oneself the decisive battle of the future between modernly equipped armies, taking the battles of 1918 as a background, the picture conjured up is a concentration of mighty masses of iron (artillery and tanks) in conjunction with aerial battle squadrons and storm infantry, the latter not very strong numerically, but of outstanding excellence. It appears out of the question to try to make such artillery masses rely on ground observation in a war of movement. It would be impossible to find time to choose the great number of observation-posts, still more so to carry out the extraordinarily technical and difficult task of shooting from observation-posts pushed far forward and to a flank. Shooting with ground observation could only be made possible for individual units, which were specially favourably situated therefor. Anyone who thinks that the above-mentioned technical difficulties can be avoided or reduced by pushing forward the whole

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artillery close to the foremost limit of the area held, underestimates the importance and difficulty of ammunition supply. Hence, he who looks for a decisive result in a war of movement must direct very special attention to shooting without observation.

Further, for all aerial observation on a big scale, a complete technical mastery of shooting without observation is essential; for the capability of the aerial observer will be unduly tested, if the fire which he is to direct is not in the first place directed by the battery commander's orders on to approximately the spot desired by the airman.

The above remarks refer solely to the independent battle artillery. The weak artillery formations, which, subordinated to local infantry commanders, are in close touch with infantry advancing to the attack or accompany an advance guard feeling its way forward to the enemy, are auxiliary infantry weapons and their employment is regulated by special laws. But, for the preparation of the independent battle artillery for the mobile decisive fight, work should be continued on the principles laid down by Pulkowski and others in 1918. The commander of a force should order the quantity of iron or chemicals (both as far as possible expressed in tons) with which a definite portion of the enemy area is to be plastered and also the time, direction and intensity of the barrage. The details, including calibres and battle-positions, should be left to the higher artillery commander. The duties of the higher artillery command should be thoroughly reconsidered and divided from those of the general command with a view to greater economy of energy.

Units must be capable of independent and rapid cartographical resection of their fire-positions. It is then probable that shooting with ground-observation will be gradually banned from mobile warfare and relegated to position warfare and will gradually follow the path along which the cavalry charge, the infantry struggle for fire-superiority, and the open artillery position have preceded it.

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THE NEW MAP OF EUROPE.

A Lecture delivered at the Royal Artillery Institution on Tuesday, 30th January, 1923.

BY FRANK J. ADKINS, Esq.

Major-General Sir John R. Longley, K.C.M.G., C.B., Commanding South-Eastern Area, in the Chair.

CHAIRMAN: Gentlemen, I have much pleasure in introducing to you to-night Mr. Adkins, who has been good enough to come here to tell us about the map of Europe which is, as you know, constantly fluctuating at present.

I will not take up your time by saying anything more but I will ask Mr. Adkins kindly to begin his lecture. (Applause).

THE LECTURER: Gentlemen, since frontiers enter so largely into this subject a few words about frontiers in the abstract are perhaps worth while by way of introduction.

Good frontiers provide actual barriers or No Man's Land between States, e.g., the sea, a mountain water-shed, marshes. Bad frontiers on the other hand, are those purely arbitrary and ever-shifting lines traced by successive peace treaties (the straight-line frontiers one sees so often in the New World have as their original an old line drawn by the Pope between Spanish and Portuguese Brazil). A river line is not a good frontier. Bridgeheads are required beyond it; and moreover, it divides an area which has been united by Nature; namely, the Basin drained by the river. The redrawing of frontiers always intensifies the difficulties of Irredentism; of the minority left on the wrong side of the frontier and trying to rejoin the majority. No frontier can be so drawn as to make clear divisions. If a process of exchange of holdings and sorting out on both sides of a given frontier can be organised, greater stability is likely to result. Lastly, frontiers which cut up economic units and separate mutually dependent and complementary areas are obviously sources of future trouble.

Turning from the unsatisfactory fringes of States, let us now consider the nature of the growing principle by which States have been formed from their original nucleus. The habitable land of a temperate area like Europe is of two kinds; either the low-lying and originally tree-covered valley of a river, or else the grass covered uplands of the watersheds and plateaux. These two sorts of land attract two types of man. The valley forests are gradually cleared by the settlers; the upland grass-lands are the grazing grounds of the nomads. The settlers in the course of generations clear the forests to the watershed

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and following the river course reach the sea at its mouth: as the Poles did along the course of the Vistula, long before the Brandenburgers sent their crusading Teutonic order eastward to conquer the Slav Prussians.

The settlers are the builders-up of nationality, based on agriculture and held together by a common language and customary law. We might imagine therefore that national areas undisturbed and developed under ideal conditions would coincide with river basins, and national boundaries follow watersheds. But such undisturbed development is never found. The lowland settlers are frequently raided by the more vigorous of the nomadic peoples, whose incursions, though destructive for the moment are also in the long run stimulative to the slower moving settler type. Where fusion of the two has taken place a more energetic race has, as a rule, resulted. But frequently such fusion has not occurred and thus we find in most parts of Central and Eastern Europe, two distinct types intermingled; the settler agricultural peasant, and the ruling class descended from the original nomads: and in particular from those blue-eyed light-haired Nordic nomads of Scandinavian type who play so large a part in the history of Europe. Lastly, in so far as a middle class of traders and professional men exist in these parts of Europe, such a class is supplied from a third source; the Alien or Jew. The fusion of these contrasted types is a difficult business and Nationality as we know it in Western Europe where definitely French, English, Dutch, Swiss, Belgian and Spanish nations are to be found—even in spite of mixture of languages as, e.g., in Belgium and Switzerland—becomes progressively more hard to determine as we move eastwards across Europe.

I propose therefore to leave out of account the whole of West Europe. Such changes as the French recovery of Alsace-Lorraine belong to another category from the changes in Central and Eastern Europe, and I do not propose to plunge into the Empire of Charlemagne and the partition of Verdun to trace the varying fortunes of that No Man's Land between France and Germany, Lothar's Kingdom (Lothringen or Lorraine) which becomes one of the chief battle lines of the continent.

On the east my subject is also limited. Europe is really one of the peninsulas of the great mass of Asia; and Europe of the sea may justly be regarded as springing from the continental mass along the line which now forms the western boundary of Russia. Russia is now geographically Asiatic; perhaps also its outlook tends to become increasingly Asiatic. At any rate, I exclude Russia from the lecture.

In studying the remainder, we have first to note the influence of the two great inland seas, the Baltic and the Mediterranean, on the land mass. The Finnish movement southward helps to give us that fringe of non-Slav peoples along the Eastern Baltic which has crystallised into the new states of Esthonia, Latvia, Lithuania; while the earliest rule in Russia was that of the Swedish house of Rurik which at one time extended as far south as Kieff; a notable example of Nordic domination of the Slav. The Bulgars also may be partly Finn.

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The Mediterranean influence has been more profound. Rome and Constantinople, capitals of the Western and Eastern Empires, become the civilising centres whose influence, chiefly religious, spreads throughout the continent. Even Protestant Europe is only reformed Roman, while the Roman Church is but a branch of the Orthodox church which still centres in the Patriarch of Constantinople. In between the two churches, occupying the Ukraine (Ruthenia) and Transylvania we find the Uniate Church; Orthodox in form but acknowledging the Pope. Further, to Rome, we owe those conceptions of Law and Union which express themselves later as the Holy Roman Empire, International Law, etc. The Pax Romanum may be compared with the League of Nations; and W. T. Stead used to advocate the re-establishment of the arbitration powers of the Pope. Lastly, Roumania is in a sense Roman; ancient Dacia, with a language moulded on Latin lines.

We can now turn to that portion of Europe which lies between Russia and the Rhine; and across this area I wish to draw yet another line, a line running due north from Venice. I wish, for the purposes of this lecture to regard this line as marking the westward limit of the Slavs; for it is about the Slavs that I am chiefly concerned in this lecture. Whether the words Slav and Slave are connected or not, the Great War may be regarded essentially in its results as the freeing of the Slav and the re-establishment of those ancient states which existed in Europe before the Empires based on Teutonic or Turkish domination were built up out of them.

If then, we can imagine the Slav as spreading originally over the whole of Europe east of this line we have the basis we need. But as I have said already, this basic mass of peasants is subject to penetrations; and it is these penetrations we now have to trace.

The first is the Teutonic penetration which in the guise of a crusade led the Teutonic Knights of Brandenburg under their Hohenzollern leaders along the Baltic. From the younger sons of these Baltic barons, essentially German although Russian subjects, the pre-war Russian bureaucracy was largely recruited. Russia was thus largely a Slav body with a German head. The other Teutonic penetration took the form of an advance along the Danube to the point where it enters the great plain of its basin, i.e., to Vienna, which becomes the bulwark of Christendom against the Turk, after he had overwhelmed the ancient bulwark of Constantinople in 1453. Vienna is thus a pivot of Europe : the point at which the two Imperial races, Teuton and Turk, wrestled for Europe over the prostrate bodies of the older Slav States. As the Turk was pushed back Austria grew by the absorption of the reclaimed lands until it became the great composite Empire we knew before the war. With its Magyar extension and the Latinised Roumanians to continue the line to the Black Sea we have a non-Slav band stretching right across the centre of the Slav area and dividing Slavdom into two portions; the northern (Russians, Poles, Czechs, &c.) and the southern (the Serbs, Bulgars and others of the Balkans).

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Perhaps the most striking point to note about the new map is to see what has happened to this dividing band of non-Slav States; (the Magyars are more of the Turanian or Mongol type than white) it is still there, but so thin and shrunken that (with the exception of Roumania which has of course swollen out enormously at the eastern end of the band by absorbing Transylvania from Hungary and Bessarabia from Russia) at one time Hungary at any rate seemed to be in danger of being pinched out altogether. The new states of Poland and Czecho-Slovakia on the north and of Yugo-Slavia on the south have been constituted by the break up of the Empire which originally represented the reward and result of the Austrian championship of the Cross against the Crescent.

The second penetration is from the south-east and has already been referred to more than once; it is the Turkish penetration from Asia which began in the middle of the 14th century but made its greatest headway after the fall of Constantinople in 1453. (It should be noted of course that Constantinople had been Christian for a thousand years before it became Mohammedan; and that it is still a great Greek Christian centre).

The Turkish advance into Europe continued until it was checked before Vienna by John Sobieski, King of Poland, about 250 years ago; but from that high-watermark the Turks have been receding ever since as a study of any historical atlas will show. We cannot however pursue the consequence of this penetration for the moment; we must leave it until we have dealt with the northern Slav States, Poland, and Czecho-Slovakia.

There was a great Moravian Empire stretching indefinitely into Russia in the ninth century. Bohemia was a Duchy before Vienna appeared on the map. The University of Prague is the oldest north of the Alps. The Prince of Wales' Feathers were originally the crest of the King of Bohemia, killed at Cressy, 1347. John Huss is the connecting link between our Reformer Wyclif, and the German Reformer Luther. The Winter Queen whose expulsion from Bohemia led to the Thirty Years War which reduced Germany to savagry, was a sister of Charles I. The Bohemians should have had a position within the Austrian Empire at least equal to that of Hungary; but the old Emperor Francis Joseph, always refused to go to Prague to be crowned. The new President Masaryk, was a professor of London University in the days of his exile. The new state has great resources but it is landlocked. The internationalisation of the Elbe, the Oder and the Danube, give her some sort of access to the sea at any rate in peace time; and Pressburg is becoming an important Czech Danube port. Moreover at Hamburg and Trieste, the Czechs have customs free areas. Nevertheless the tradition of Vienna is still strong enough to draw and retain much of the business and banking of the new state—and still more of south-east Europe. (If anything could be done to save Vienna from sinking to the size of a capital of a few million Austrian-Germans, Europe would be the gainer. Its central position has suggested to some that it might make a good seat of the League of Nations).

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The new Poland is in a less assured position. Three hundred and fifty years ago Poland reached almost to Moscow and Odessa. We have seen what Europe owed to the Poles under Sobieski. But Poland, although able to save Europe, could not save herself. As a result of three partitions she was absorbed by her neighbours, Prussia, Austria and Russia. Napoleon however, reconstituted her for a moment in connection with his Moscow campaign as the Grand Duchy of Warsaw. French support of the new state is thus on historical lines. Nevertheless if Poland is to play the part assigned her of a state to keep apart those two complementary states Germany and Russia she will need very exceptional political qualities; and the story of her past hardly suggests that she possesses them. Moreover, in pre-war days the ally of France was not Poland but Russia; and if ever the unofficial feelers between France and Russia now to be observed should become more definite, possibly French interest in Poland would take a somewhat different form.

We turn now to the southern Slavs of the Balkans who had been overrun by the Turks and kept marking time for centuries. The Turk, unprogressive himself, had no use for progress among his subject people who nevertheless managed to retain their Faith and their sense of Nationality. The primitiveness of Turkish political ideas may be judged from the fact that only in the year 1922, did they venture to separate the Temporal and Spiritual powers of the Caliph. Their rule is a militant Theocracy and therefore unlikely to meet the needs of other races and creeds and the complexities of modern conditions. The rate at which they lost their huge empire, stretching as it did originally from Vienna to the Persian Gulf and from the Caspian to the Red Sea, is an indication of their political and administrative limitations

The Greeks, helped by Lord Byron, were the first to shake themselves free about a century ago. But the Slav peoples did not agitate effectively till after the Crimea. In the twenty years however which separate that war from the "Jingo" war between Russia and Turkey, Russia is encouraging her younger sisters of the Balkans against the common enemy; and the Treaty of Berlin in 1878, redraws the map of the Balkans so as to leave Turkey merely the strip from the Adriatic through Albania to the Bosphorus with which we were all familiar in our school days. But the shrinkage of Turkey continues in the twentieth century also. The revolution of 1908 lost her not only the suzerainty of Bulgaria (Prince Ferdinand becoming a King and "Czar of the Balkans") but also the provinces of Bosnia and Herzegovina which had been handed to Austria to administer, but not to possess, by the Treaty of Berlin in 1878. In 1908 however, thirty years afterwards, Austria seized them and thus took a step which, as we shall see directly, leads to the Great War. But the troubles of Turkey did not end with these losses. A year or two later she found herself at war with Italy over Tripoli, and this war so exhausted her that she had no strength left for the new danger which threatened in 1912.

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Venezelos had managed to bring all the neighbours of Turkey together into the Balkan League; and these Allies smote Turkey on every front with such effect that she crumpled up and retired to the Chatalja lines. But the unity which had secured this triumph broke down under the strain of dividing the spoil. Bulgaria who had done most of the fighting and secured an Egean outlet as a reward wished for a westward extension towards the Adriatic also; and thus came into conflict with Serbia over the Monastir area; while as regards Greece, Bulgaria wanted Kavalla. Thus arose the second Balkan war of 1913, in which Bulgaria suffered defeat in the west. The Turks, moveover, seized the opportunity of Bulgarian weakness to push their frontier back again to Adrianople while even Roumania seized the same opportunity for pushing her Dobruja frontier further south. Thus was the backwardness of the Balkan States, due as it was to centuries of stagnation and arrested development under Turkish rule, emphasised.

I have already spoken of the seizure of Bosnia and Herzegovina by Austria in 1908 as important: as leading indeed to the Great War. In the eighth century Serbia extended along the whole of the Adriatic shores westward to a line which took her west of Istria and back northward to the Drave. Thus originally the two provinces which had gone in 1908 to Austria were part of Serbia and remained so at any rate till the middle of the twelfth century. The Serbs had always expected to recover possession of these provinces on the break-up of Turkey and when they found them seized by Austria, they determined to prevent them from settling down as Austrian provinces. To deal with the irredentist movement thus started, Austrian army manœuvres were organised in the new provinces and in connection with these the Austrian heir the Archduke Ferdinand paid a visit to Sarajevo, which ended in his assassination on June 28th, 1914.

The establishment of Yugo-Slavia as the greatest of the Balkan States with a long coastline on the Adriatic has caused some anxiety in Italy, who has of course, inherited the Adriatic traditions and position of Venice. The Doge was Duke of Dalmatia. Venetian factories and trading stations like "Zara Italianissima" dotted the whole of the Balkan coast as European stations to-day dot the coast of Africa. When therefore the Slavs of the hinterland awoke to national consciousness they found all their ports and openings in Venetian hands. The story of D'Annuzio and Fiume is thus, in a sense, a throw-back to a picturesquely mediæval period. But Italy is wiser than her warrior poet and has agreed to arrangements on the opposite coast which give to the new state all the openings she needs. Zara alone remains under Italian protection; also the island of Lagosta, while one of the two channels between the islands of Fiume is mainly Italian.

Nevertheless, the contrast between the two coasts of the Adriatic is still striking and we can understand Italian anxieties as to the possibility of developments among people so newly freed and in consequence so relatively undeveloped as the new states which face her across the Adriatic.

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DISCUSSION.

CHAIRMAN: If any gentleman would like to ask the lecturer any question on his lecture, he will be prepared to answer.

COLONEL GOSSETT: I would like to make one observation upon what we have heard, General Longley. There are at present four Frontier Delimitation Commissions working in Hungary alone to each of which there is attached a British officer, and in view of the probability that there will be many more Frontier Commissions of the same character appointed, I think it is most important that we should remember what we have heard to-night: what is a good and what is a bad frontier as laid down for us by Professor Adkins. I would especially like to draw attention to the fact brought out by him that any navigable river is an extraordinarily bad frontier. Trade flows down the river valleys and not along the mountain tops.

CHAIRMAN: Has any gentleman any further questions to ask or remark to make? If no one else feels inclined to say anything, it only remains for me to convey our very great thanks to the lecturer to-night. He has given us a great deal of information and I think he is very much to be congratulated on having been able to condense all he has said to us into the time that there was available for him. We have learned a great deal about Europe which personally I did not know before, and I think that what he has told us about frontiers is what we ought to all know and it is very worthy of our bearing in mind. My own feeling is that there is not very much that we can discuss to-night regarding the lecture because most of it is very new, but I can assuredly say that we have learned a great deal and I think our thanks therefore are due to Mr. Adkins for all he has been able to convey to us. (Loud and continued applause).

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EXAMINATION OF MATERIALS BY X-RAYS.

BY V. E. PULLIN.

Director of Radiological Research. Research Department.

THE fundamental fact of the greatest importance when considering the development of X-Ray apparatus and technique for inspection purposes, is that here we have a method which enables the interior of a body to be examined without opening or cutting into it. It requires but little imagination to recognize that this fact in itself is of the greatest value; and every bit of progress that is made with regard to the power and scope of such a method, is a step towards perfection and economy of manufacture of all stores.

It is only of recent years that the examination of materials by X-Rays has been possible. In the early part of 1917, research on the subject was started by the War Office in the Research Department, Woolwich, on an experimental scale; and it is noteworthy that when, at that time, the subject was investigated by a Scientific Committee appointed for the purpose, it was found that the greatest thickness of metal that could be usefully penetrated under the most favourable conditions then commercially available was half an inch of iron.

Prior to 1917, X-Rays had been almost exclusively used by the medical profession chiefly as a method of diagnosis and for the purpose of locating foreign bodies. It was not until the question of the possibility of utilizing this phenomena for the purpose of locating flaws in shell was raised by the Research Department, that the general use of the rays for commercial purposes was to any extent contemplated.

As will be shown later the power of X-Rays to penetrate opaque and massive substances depends upon the wave length of the radiation. This called for specially designed X-Ray tubes and also step up transformers of very high voltage. Neither of these pieces of apparatus were then commercially obtainable. Certainly X-Ray coils and transformers could be purchased, and they were of comparatively high power but they were designed for medical work and were not built to give large output for continuous running, nor were their voltages high enough. The same thing applied to X-Ray tubes. Until the advent of the Coolidge tube in 1913, any X-Ray work requiring rays of exceptionally high penetration was impossible; and it was undoubtedly the development of the Coolidge tube which brought the subject of examination of materials within the limits of practical possibility.

When the question was first considered at Woolwich, it was realized that if any progress was to be made in this absolutely new subject, the investigation would have to be of a very extensive nature. It

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would have to include the design and construction of special ultra-high tension transformers, and also the construction of experimental X-Ray tubes of various types. Such a research was organized and all the branches of the work developed as far as was possible under the somewhat limited conditions that were necessarily in force in a Service Research Laboratory.

The general results that have been obtained up to the present, while not having yet produced the complete revolution in examination, inspection, and consequently design of service stores which is inevitable when the subject is a little further developed, yet have proved of great value in a variety of ways.

It is now possible to show flaws in a slab of steel three inches in thickness. It is possible with suitable technique to measure, for example, with an accuracy of ·001 inch the fitting of the internal parts in a vent sealing tube; and it is to be noticed that this can be done by X-Rays without destroying the specimen and without sectioning which, where small dimensions are involved, often results in a certain amount of distortion of the parts which it is desired to measure.

X-Rays have been used in the service for many other purposes. They are used, for example, to show flaws in large metallic ingots thereby saving expensive work which might otherwise be done on defective material before flaws were cut into.

By a simple device similar to that adopted in medicine for the location of foreign bodies, any small flaw in a mass of metal may be accurately localized. In such a specimen it may be found, for example, that flaws exist almost entirely in the vicinity of one surface say to a depth of a quarter of an inch. Though the actual surface itself may be sound, X-Ray examination will show, in this case, that if the ingot be planed down to a suitable thickness it is then sound and may be safely worked. There is no other method of inspection which will yield information of this kind.

The thickness of the ingot is at present the limiting factor in this type of work and it is not *practicable* to examine ingots of high density, e.g., brass, of more than $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in thickness.

The X-Ray examination of welds is another branch of this work which is proving to be of considerable value. It is clear that welding is not used by any means as extensievly as is desirable on account of the fact that there is, or rather was, no method of examining a weld in situ—no method except a tensile test which of course involves destruction of the specimen. However expert the welder may be, cracks, blow holes, and other defects do develop which destroy the value of the weld and may be a source of danger. Figures 1 and 2 are examples of radiographs of welded steel plates of one inch in thickness; internal flaws are shown. It is clearly of the utmost importance to develop X-Ray apparatus and technique in such a way that it may be applied generally to this use as there is no other method of performing the examination. Another valuable application of the rays is to examine a known fault in any specimen; whether it be an unworked ingot or an elaborate piece of work, e.g., the recuperator body of a gun. A

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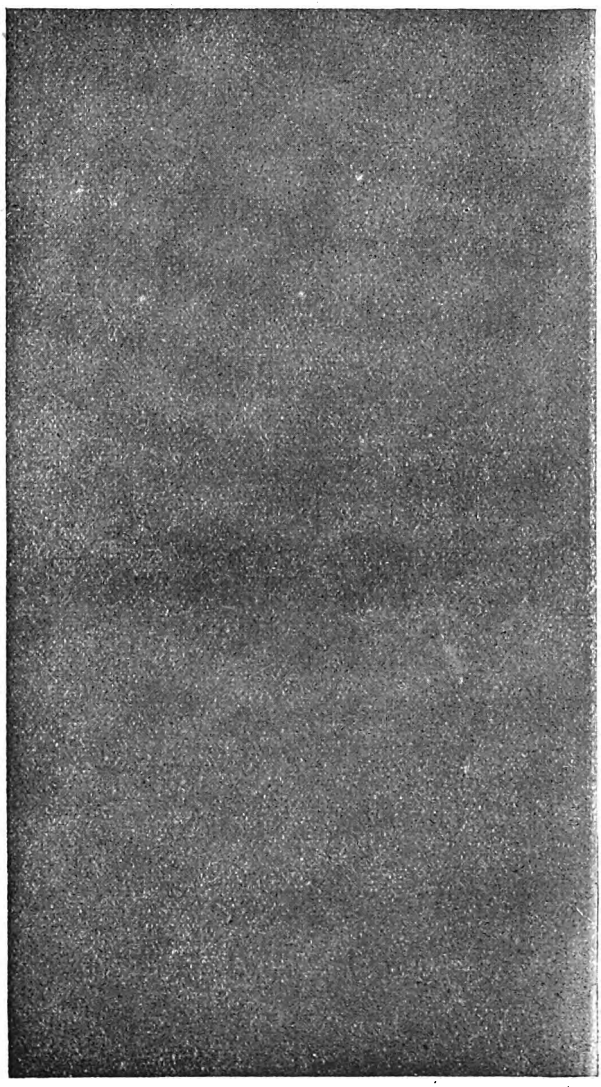
The X-Ray examination of foreign and unknown ammunition has proved of the greatest value, for by its aid the dangerous task of exploring the inside of a highly explosive, and at the same time harmless looking bullet, has been changed from a distinctly dangerous operation into the comparatively harmless one of sectioning something of observable internal construction.



Weld comparatively free from flaws.
Fig. 2.

Figures 3 and 4 are radiographs of foreign explosive ammunition. In the course of the work of a Service Research Department, it is

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obvious that the scope of X-Rays is practically unlimited even at the present state of its development. With regard to examination of aeroplane parts the value of X-Rays would be appear to be enormous by virtue of the thinness and transparency of the materials used. The application of Radiology to this purpose has been demonstrated in this

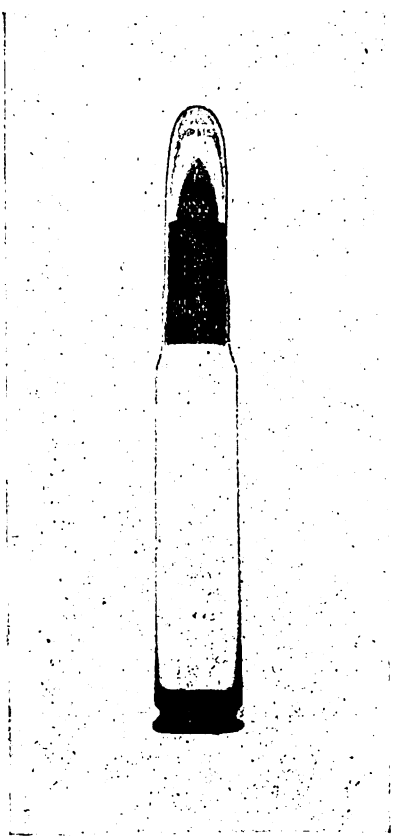

Fig. 3.

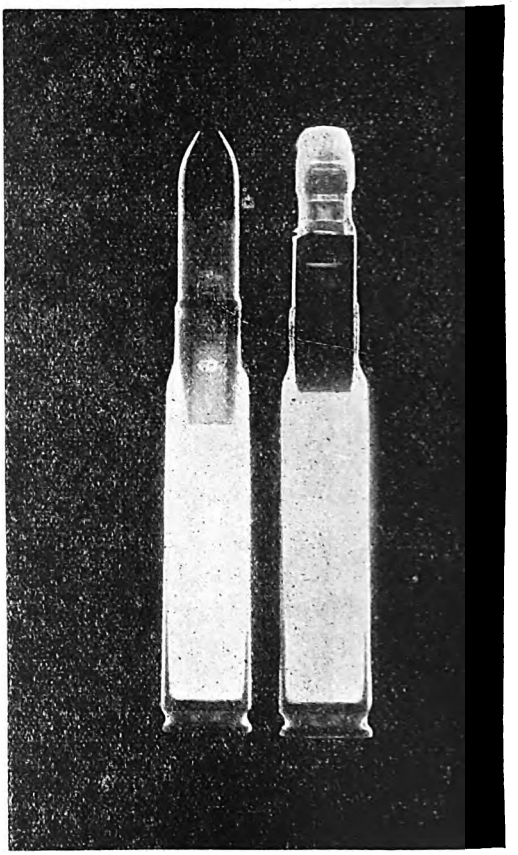

Fig. 4.

country again and again, but its use does not appear to be as general as one could desire. Other countries however, have adopted this method of examination very generally as a routine practice.

A propos of this it is interesting to note that X-Ray installations are now being provided on a large scale in Research Departments of foreign arsenals, and their use in connection with ordnance materials is very much increasing.

Radiology as applied to the study and to research in materials is yet in its infancy, and its development is urgently called for, but this development is necessarily slow. As research in the subject proceeds, and the requisite apparatus is designed, difficulties are constantly met, which must be dealt with and solved as they appear. The

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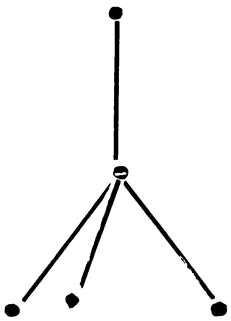
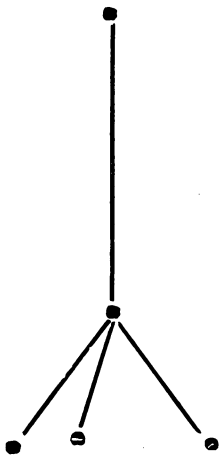
physics of an ordinary X-Ray tube is not by any means an understood subject, and when dealing with the very high voltages which are necessary for this work, the physical aspect becomes formidable and offers a series of problems so numerous and of such complexity that it becomes in a sense a new and separate branch of physics.

There is one aspect of modern X-Ray development which will certainly prove of the greatest value to service research work, that is the examination of materials by the X-Ray spectrum method. The pioneer work of Laue, Moseley, Debye and Scherrer, A. W. Hull, and the Braggs on this subject, is now beginning to bear fruit in a practical manner. An instrument is now placed in the hands of the Chemist and the Metallurgist with which investigations may be continued in realms far beyond the power of the microscope. By the aid of this instrument we can measure distances which are totally unappreciable by any other method. The principles which may underlie questions of the effect of strain in materials, stability and decay in explosives, and in fact the very constitution of matter itself are brought within measurable study by the aid of X-Rays. The enormous importance of this work is not appreciated except perhaps by the trained and specialised physicist. Surely the romance of science has no more striking illustration than in some of the early experiments in this connection. Professor W. H. Bragg has shown us in the most beautiful manner exactly how the diamond is built up of its individual atoms, and has demonstrated the wonderful regularity of the lattices which they form; he has shown us by this method how very little differentiates the common and valueless piece of graphite from the almost priceless diamond—merely an alteration in the spacing of an atom. Figure 5 is a diagrammatic representation of the arrangement of the atoms constituting the diamond lattice, and Figure 6 that of Graphite.





The dots represent carbon atoms.

Fig. 5. Fig. 6.

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Remembering that the distances represented by the lines in the diagram are in the neighbourhood of one millionth of a millimeter, it is awe inspiring to contemplate the vast differences that do depend upon the relative positions of these infinitely ultra-microscopic particles. Also incidentally the fact that their detection is the product of centuries of accumulated learning.

The subject of crystal analysis by X-Rays is perhaps one of the most fascinating branches of Physics, quite apart from its applied value.

The fundamental principle involved is the wave length of X-Rays. Radiation is known now to be of exactly the same nature as light, only of very much shorter wave length, in fact something in the nature of 10,000 times as short, and it is owing to the fact that this wave length is commensurate with the distance separating the atoms in a crystal that reflection of the X-Ray beam, and consequently the measurement of these minute distances becomes possible.

Figure 7 shows an arrangement of the apparatus in the Research Department at Woolwich, which is used in the study of crystal form in explosives and other materials.

In this apparatus advantage is taken of the fact that X-Rays have the power of rendering a non conducting gas, conducting. The beam of X-Rays after passing through two slits impinges upon the specimen to be examined, and if this substance is crystalline a fraction of the beam is deflected.

The Ionization chamber is then made to pass through a series of angles, and when a reflected beam of X-Rays enters the chamber, ionization of the gas occurs, and a current passes which is recorded in the electroscope. The angles are read on a graduated scale on the disc shown in the photograph and the intensity of the reflected beam, is of course, measured by the amount of ionization as recorded by the electroscope.

A is the X-Ray tube.

In this particular instance it is a tube made of metal having a special target, the tube is water cooled and is run continuously on the pump P.

B is the ionization chamber.

C is the graduated disc.

D is the Electroscope.

E is a reservoir containing an iced water supply to cool the target of the X-Ray bulb.

F is one of the slits through which the X-Ray beam passes before reaching the specimen placed at G.

H is a device which enables the fluctuations of the X-Ray tube output to be checked, and supplies a correcting factor in the final readings.

This fluctuation is due primarily to variations in the primary generator circuit and also to vagaries of the X-Ray tube itself.

The relationship between the primary beam of X-Rays and the reflected beam as observed on the scale is expressed by—

$$N\lambda = 2d \sin \theta$$

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Where λ is the wave length of the X Radiation
d is the distance separating the crystal layers in any place
θ is half the angle through which the beam is reflected
N is the *order of the spectrum.*

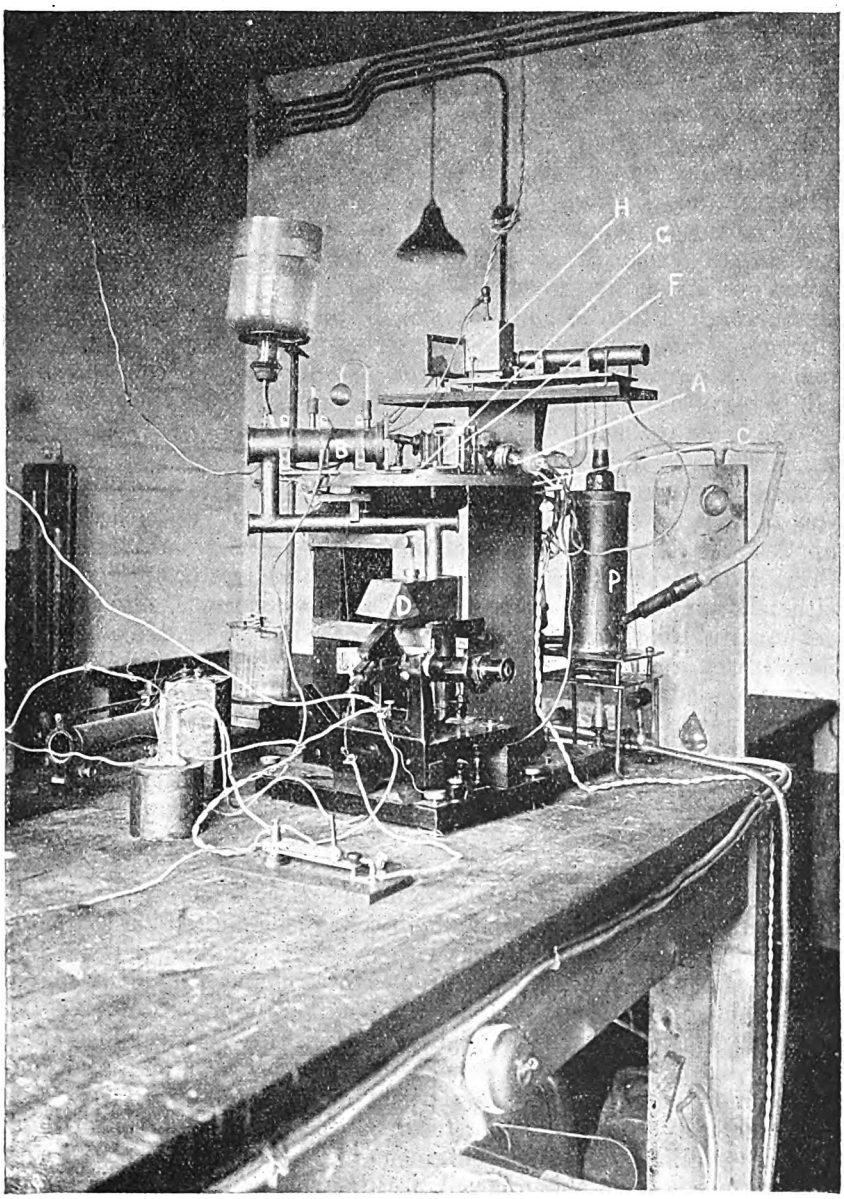

Fig. 7.

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It will be seen that by the use of this instrument for the examination of a specimen, a series of values will be obtained for d and at the same time the intensity of the reflected beam will vary for different angles, hence for each order of the spectrum we shall have these two varying tables from which it is possible to reconstruct the form of the crystal under examination. It is to be observed that the analysis of a crystal by this method has no relation whatever to the external facets or *shape* of the crystal.

It is also to be noticed that the wave length λ must be known. A tube is therefore constructed having its target made of a metal which is known to yield, under suitable conditions, a maximum amount of X Radiation of a given wave length. The unwanted components of the total beam may be filtered off by means of a suitable screen.

The present application of this method of investigation is concerned with explosives with the idea of investigating their physical properties in relation to stability and deterioration. A large field of similar work is open in Metallurgical Research. The study of crystal change in Iron at various temperatures has been the subject of investigation by Westgrin, and similar work on Service problems will certainly result in new information of considerable importance.

It would perhaps be as well to consider very roughly the principles which underlie the examination of materials by X-Rays. There are several factors involved. In the first place it may be generally stated that the penetration of metals depends almost entirely upon the voltage applied to the terminals of the X-Ray tube; consequently the first thing for consideration is the high tension generator. This may either be a closed core oil or air insulated transformer, fitted with a commutating device for producing uni-directional current, or it may be an open core transformer with an independent "break" in the primary circuit commonly known as an induction coil. Induction coils produce inverse current, or current in the wrong direction, which if allowed to pass through the X-Ray tube would be very harmful as it might result in its destruction. It is therefore necessary that some type of rectifier should be provided with a coil, the most suitable being a system of valve tubes.

The difference between a transformer required for X-Ray work, and one required in general engineering practice, is merely one of output. In X-Ray work, extremely high voltage is required but comparatively small current, never more than say 100 milliamperes. The voltage must be in the neighbourhood of 250,000 v. and of course the machine must be capable of continuous running.

The production of ultra high voltages is a very great insulation strain, and the problem involved in the satisfactory design and construction of such generators, are not by any means all solved.

Generally it may be understood that for the examination of thick metallic specimens, and for continuous inspection work, a closed core transformer is preferable to a coil. Although the initial cost is higher it is probably the most economical proposition in the long run.

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There remains the question of the X-Ray tube and the technique to be employed. It has been said that the penetration of materials by X-Rays depends upon the voltage across the tube; this is so because actually it depends upon the wave length of the radiation, which is controlled by the velocity of the Cathode stream. The higher this velocity, the shorter the wave length of the resulting X-Rays; and the greater their penetrating power. The velocity of the Cathode stream increases with the strength of the electric field between the electrodes. The average speed of the Cathode stream required to produce the necessary short wave radiation to penetrate thick pieces of steel is about 25×10^9 cm. secs., requiring a voltage of 150,000—200,000 volts. Another factor involved is the absorbing power of the material, and this depends upon its atomic weight. Bodies of high atomic weight have very large absorbing capacity. This fact is very well illustrated by the ordinary medical radiograph, the bones being of greater density than the surrounding tissue, they absorb more of the X-Rays, with the result that their shadow is thrown on the screen or photographic plate.

Every X-Ray beam is heterogeneous, that is, it is made up of wave lengths of different values. Long waves are very much more easily absorbed than short ones, but in the radiography of a specimen, it is only the emergent beam which affects the photographic plate. This beam clearly being the short wave, or hard component of the original beam, the remaining portion has been absorbed and scattered during its passage. In the case of Metal Radiography the percentage of radiation that does eventually cause the image to appear is very small. If we were able to impinge a beam of homogeneous radiation upon a slab of steel, and arrange for this beam to pass through it and emerge on the other side, the intensities of the radiation before and after traversing the slab would be given by

$$I = I_o e^{-\mu d}$$

where d is the thickness of the slab and e the base of natural logs. μ being the coefficient of absorption of X-Rays for that material. This absorption coefficient is usually expressed by the ratio $\frac{\mu}{\rho}$ (which is called the Specific Absorption Coefficient). Its density being represented by ρ.

The variation of absorption in different metals is illustrated by the following instances :—

Metal.	Atomic Weight.	Density.	Specific Coefficient of Absorption $\frac{\mu}{\rho}$
Aluminium	27·1	2·6	0·97
Iron	55·9	7·7	7·5
Copper	63·6	8·9	8·1
Ag.	107·9	10·5	17·7
Pt.	195·2	21·5	22·0
Lead	207·1	11·35	22·0

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The penetration of metals by X-Radiation increases with the voltage and it would appear that if a tube can be run at 300,000 V. it will enable us to usefully penetrate a thickness of 6 inches of steel.

Referring for a moment to the phenomenon of scattering. Not only is scattering largely responsible for the very low efficiency of the incident X-Ray beam, but also it may render the photograph valueless, because a certain amount takes place at each surface of the specimen. In common with the original beam, it has the power of affecting a photographic plate. It follows that very careful selection of the type of radiation is necessary if the best results are to be obtained. Certain corrections must be made for the effect of scattering.

When X-Rays fall upon a body, they generate in that body, certain radiation identical in properties with themselves, and having wave lengths characteristic of the material. This characteristic radiation depends upon the frequency or wave length of the incident beam of rays but to a certain extent it is always produced. It is troublesome when radiographing specimens and may effect the photograpic plate sufficiently to blot out or seriously interfere with the image. It may be excited in the bench or table on which the plate is placed; therefore, it is of the greatest importance that care must be exercised to protect the entire neighbourhood of the plate with screens of highly absorbent material. Lead is generally used for this purpose. As will be seen from the preceding table, the absorbing power of this material is very high and of course it has the additional merit of comparative cheapness.

The X-Ray examination of materials, apart from crystal analysis may be done in two ways. It may be done photographically (by Radiographs) or it may be done by means of a fluorescent screen. The consideration of the first method involves a study of the effect of X-Rays on a photographic plate. The sensitive emulsion of such a plate consists essentially of an emulsion of silver bromide in gelatine—after exposure to light the plate is "developed" which is merely the application of a reducing agent which effects the change of the silver bromide particles into silver. The parts of the negative which have received the strongest exposure are, after development, the richest in silver and form the densist part of the image. X-Rays have the same effect upon a photographic emulsion as light. The long wave radiation has the greatest photographic action, but on the other hand it is essential to use radiation of sufficient penetration (short wave length), to secure transmission of a sufficient amount of it to act on the emulsion of the plate. The photographic action of X-Rays is proportional to this absorption by the emulsion, hence X-Ray plates have comparatively thick emulsions and thus require rather longer development than ordinary photographs. It will be seen that as the percentage of radiation which emerges, after passing through a thick metal specimen is very small, the photographic effect will be small and exposures in metal Radiography therefore tend to be prolonged. In order to reduce exposures to within practical limits, use is made of the fact that certain chemicals fluoresce under X-Rays. If they are placed

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in contact with the film of the plate, their actinic action, when stimulated by the radiation, has the effect of reinforcing the action of the X-Rays on the emulsion. These screens—known as Intensifying Screens, are made by spreading a thick layer of the fluorescent material—usually Calcium Tungstate, upon a piece of cardboard, and arranging to place it in intimate cantact with the emulsion of the plate. They are of course exposed with it.

The drawback in the use of Intensifying Screens is due to the fact that the Calcium Tungstate is granular and the large graining is recorded on the plate. This may have the effect of confusing the image. It is especially troublesome when fine detail is required, for example the detection of small flaws, themselves perhaps no bigger than the graining of the screen. The exposure however is considerably reduced by their use, and that, under propitious circumstances, by as much as 10 times.

In order to obtain radiographs of cylindrical and awkardly shaped articles, X-Ray films are used which can be very easily adapted to most conditions.

Visual examination of materials is obviously the most desirable method of conducting X-Ray inspection. The screens in common use for this purpose are made either of Barium Platino Cyanide or Cadmium Tungstate both of which become brightly illuminated when irradiated; but in order that detail may be visible to the eye, a very much higher degree of X-Ray intensity is requisite, hence at the present time it is quite impossible to obtain results involving the penetration of thick or heavy articles. Visual examination, from the point of view of penetration is at present confined to the inspection of $\frac{3}{4}$ of an inch of steel. Butt welded steel bars of this thickness are easily examined and small flaws in the weld detected by means of a screen, but the X-Ray output required is very large. Research on the subject is, however, in progress, and there is every reason to believe that the time is not far distant when the visual examination by X-Rays of large metallic ingots will not only be possible but also a universal routine practice.

There is one other aspect of the applied science of Radiology about which a good deal has been written. Danger from X-Rays is most certainly to be apprehended. Their physiological effects are very marked and many of them very obscure. The development of the subject has cost the world some valuable lives, and many pioneers are now suffering from incurable conditions entirely caused by their self sacrificing devotion to this subject.

Fortunately we are now able to provide, to a very considerable extent, against these mal-effects. The harmful action of X-Rays occurs in the tissues, the skin, the blood and other parts of the body which may have received large doses. It occurs as a result of absorption of the rays by the tissues and protection may be afforded by arranging that in no case does any person stand a chance of receiving a dangerous amount. In all modern X-Ray installations the tube, the

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very focus as it were of the trouble, is completely surrounded by absorbent material (usually metallic lead) of sufficient thickness to absorb all the radiation. Diaphragms are fitted to the case or box which allow the rays to emerge in the narrowest possible beam, and only in the direction in which they are required. By the exercise of ordinary care, and the use of properly designed installations, and also the observance of suitable technique, X-Ray dangers are reducible to a minimum, and untoward effects are not any longer to be anticipated.

Enough has been said to give a general idea of the uses both present and future of Radiology as a method of examining materials generally, and service stores in particular.

We are only on the threshold of the subject and there is a great distance to travel, but progress is rapid and consistent and every day new applications are revealed and new demands made on the adaptability of this modern and conspicuously truthful clairvoyant.

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GROUND FIRE AS A SPECIAL CASE OF A.A. FIRE.

A review of Lt.-Colonel E. Pagezy's article on this subject in "Revue d'Artillerie."

BY MAJOR T. C. NEWTON, D.S.O., O.B.E., R.A.

(Continued).

C. Independent and semi-independent tangent elevation gears.

Independent tangent elevation. The elevating handwheel moves the gun and cradle. The T.E. handwheel moves the gun with regard to the cradle. Thus there is complete independence between the angle of sight and the tangent elevation just as in the ordinary 75 m.m. mounting.

In A.A. fire it is unfortunately impossible to take full advantage of this independence. The tangent elevation registered on the dial certainly does not change when the angle of sight is changed, but this is not what we want. What we want, is the tangent elevation that *should* be registered on the dial, and that as we know, depends on both the angle of sight and the fuze range. With a moving target these two elements change continually so that the tangent elevation setter has continually both to watch his pointer and turn his handwheel.

Further, when the target moves in a horizontal line or nearly so, the angle of sight and the tangent elevation are always varying in opposite senses. If the target is approaching, the angle of sight increases and the tangent elevation decreases. If the target is receding, the opposite takes place. In both cases the layer and the tangent elevation setter are respectively moving the gun in opposite directions.

Semi-independent tangent elevation. In this case the angle of sight is independent of the tangent elevation but the tangent elevation is no longer independent of the angle of sight. In other words, turning the T.E. handwheel does not affect the laying but turning the elevating handwheel alters the tangent elevation.

With independent tangent elevation, the elevating handwheel moves the cradle and with it

the piece
the sights
the T.E. arc complete with range dial (flat fire) or
T.E. dial (A.A. fire).

The T.E. handwheel moves the gun with respect to the cradle.

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With semi-independent tangent elevation, the elevating handwheel merely moves the sights and the T.E. arc. The T.E. handwheel moves the gun with respect to the mounting (i.e., it puts on Q.E.).

From the point of view of construction the semi-independent gear has the great advantage of substituting a plain sighting mechanism for the cradle, which must be solid and heavy since it carries the whole gun.

From the point of view of use, for flat fire the semi-independent gear gives practically the same advantages as the independent gear. The tangent elevation setter never troubles the layer and the layer only troubles the tangent elevation setter when he re-lays. If the carriage is steady, the semi-independent gear is as good as the independent gear.

In A.A. fire and with a moving target the angle of sight and the tangent elevation are continually changing. Whether the tangent elevation be independent or semi-independent, the elevation layer and the tangent elevation setter must continually turn their respective handwheels. With completely independent gear they will both have to move the whole weight of the gun. With semi-independent gear the tangent elevation setter alone will have to move the whole weight of the gun. The elevation layer will be relieved of all heavy work. He can move his sighting mechanism without any trouble and follow the target more easily. The semi-independent gear thus becomes superior to the independent gear.

There is another form of tangent elevation gear in which, unlike the form described above, it is not the angle of sight which is independent of the tangent elevation, but the tangent elevation which is independent of the angle of sight. In this case the elevating handwheel moves the gun and sights. Turning this handwheel changes the angle of sight but not the tangent elevation. The T.E. handwheel moves the sights with respect to the gun and modifies simultaneously the tangent elevation and the angle of sight.

In view of the continual variation of these two elements, this procedure is neither more nor less complicated than that of the other form of semi-independent gear. However it leaves to the layer, who has the difficult task of following the target, the additional trouble of moving the whole weight of the gun which would better have been left to the tangent elevation setter. (It may be noted that tangent elevation is applied in this way on the 3-inch 20 cwt. A.A. mounting. A disadvantage of the system is that when the tangent elevation is altered, the sights are moved by the T.E. setter and the layer has to re-lay. However, with a light gun and good gears, sustained accuracy of laying can be obtained).

The semi-independent gear permits a variety of methods of applying elevation to the gun.

The quadrant elevation can be considered as a function of the angle of sight (S) and the fuze range (F) i.e.

$$Q.E. = f\,(S, F)$$

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so that Q.E. like T.E. can be obtained direct from an apparatus of the kind described in Section B.

The tangent elevation setter, or more correctly the quadrant elevation setter, keeps a pointer moving according to Q.E., against the appropriate curve of a set of fuze-range curves inscribed on a dial or drum moving according to angle of sight. There is semi-independence since the layer is independent of the elevation setter, but the latter is not independent of the layer.

Similarly we may consider quadrant elevation as a function of the angle of sight (S) and height (H) i.e.

$$Q.E. = f_1 (S, H),$$

or as a function of the height (H) and fuze range (F) i.e.

$$Q.E. = f_2 (H, F)$$

and can apply elevation to the gun accordingly.

These two systems are known as "firing to angle of sight and height," and "firing to height and fuze-range" respectively. In the former case the fuze-range curves of the apparatus indicated for resolving the formula $Q.E. = f (S, F)$ are replaced by height curves.

In the latter case the dial or drum moves according to height and suitable fuze-range curves are inscribed on it.

Of these three methods we may say that for a moving target the method using angle of sight and fuze-range is the most suitable.

The remainder of this Section contains a fairly detailed description of various apparatus for giving elevation used on the 75 m.m. mountings. Many of the features described are due to the suggestions of Colonel Pagezy himself.

(To be continued).

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PRACTICAL INSTRUCTION IN BATTERY TACTICS COMBINED WITH THE ARTILLERY MINIATURE RANGE.

BY MAJOR D. D. HASKARD, M.C., R.G.A.

A CONSIDERABLE amount of instruction in the above subject can be imparted to the personnel of Artillery units by following the lines advocated in this article.

The system has been in use for some time in a Territorial Medium Artillery Brigade, and found to be of great assistance in the instruction of battery tactics and firing practice series with the Artillery Miniature Range. This system can be applied equally well to indoor and outdoor schemes.

Artillery officers of the Territorial Army have not a fair opportunity of keeping in their heads all the details of battery tactics, or of continually carrying out practical exercise out of doors. It has therefore been found of considerable assistance to use cards with blank headings as a pro-memoria. By this means each step is dealt with in its proper sequence and no detail is omitted. Headings which do not apply are deleted, as it is quicker to delete a word than to write it out, especially if mounted on a horse.

By dint of practice this system will assist in the proper routine becoming second nature; it further enables each individual of the Battery Staff to carry out his respective duties simultaneously, which would not be possible if the subject were taught by means of lectures pure and simple.

The scheme is so arranged as to cut out unnecessary talking and all orders are written out on the cards in the spaces alongside the headings.

INDOOR SCHEMES.

1. For the purpose of instruction two separate rooms or the two ends of a large Drill Hall are required, representing the O.P. end and the gun position end.

Gun Position.

Stores :—2 Artillery maps, Scale 1/10,000 or 1/20,000.
2 copies of the tactical scheme.
1 sand table, with the gun position roughly modelled on it, representing two squares on the map.
A number of pro-memoria cards for B.C., G.P.O. and B.L.
A supervising officer or N.C.O. will be in attendance for instruction and checking orders written out.

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Observation Post.

Stores :—1 copy of the artillery map identical to the one at the gun position.
1 copy of the tactical scheme.
1 artillery miniature range chalked out to represent 2 squares on the artillery map, enemy's position, where targets are to be expected.
Copies of range table.
Cards with sequence of orders and headings.
Cards with formulæ.

A supervising officer or N.C.O. will be in attendance for instruction and to work the miniature range.

2. Personnel :—

Battery Commander and B.C's Assistant	2
G.P.O. and G.P.O's Assistant	2
Captain and battery leader	2
B.S.M. and N.C.O. i/c Signallers	2
Telephonists	2
Total ...	10

The scheme can be carried out with a smaller staff if necessary. The personnel will collect at the Gun Position.

3. B.C's may now be issued with the following pro-forma. which gives the necessary information for the General and Special Ideas of the Tactical Schemes.

TACTICAL SCHEME.

RED FORCE.

Ref. ..... Map No. .....

Blue Force enemy .....
Red Force own troops .....
Red Force Infantry have orders to .....
attack Blue Infantry position .....
squares .....
Time ..... Date ..... Co-ordinates.
Position of C.R.A. .....
Position of Brigade Comdr. .....
,, ,, No. 1 Battery .....
,, ,, ,, 2 ,, ...
,, ,, ,, 3 ,, ...
,, ,, ,, 4 ,, ...

Orders from C.R.A. to Brigade Commander transmitted by Word of Mouth. Mounted Orderly. Telephone.

Orders by C.R.A.—Brigade will come into action .....
to cover attack .....
retirement
to bombard .....

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They will engage enemy's Batteries and other targets as seen in area. Square ( ) and ( )

	Description.	Co-ordinates.
Target No. 1.	.....	.....
,, ,, 2.	.....	.....
,, ,, 3.	.....	.....
,, ,, 4.	.....	.....
,, ,, 5.	.....	.....
,, ,, 6.	.....	.....

(A number of suitable targets and their co-ordinates will be filled in the above spaces by the supervising officer at the O.P. just before firing is to commence and not when the scheme is first issued.

4. It is a distinct advantage if the personnel taking part in the scheme be provided with armlets showing their duties, such as B.C., B.L., N.C.O. i/c Signallers, etc. This enables the various members of the staff to tell at a glance what task each person is doing.

Battery Commanders will appreciate the position in the Tactical Scheme and identify their position on the Map.

The B.C's Cards will then be issued, filled in with the necessary information, and superfluous information deleted.

B.C's Card.

(Issued by Brigade Commander).

(1) *Tactical Idea*—Attack—Defence—Retirement.

		Co-ordinates or Description.
(2)	*Rough Position* for	
	No. 1 Battery.	.....
	,, 2 ,,	.....
	,, 3 ,,	.....
	,, 4 ,,	.....
(3)	*Rough Direction of Fire*	.....
(4)	*Targets expected*	.....
(5)	*Brigade C.O.* will be at	.....
(6)	*Fast—Medium—Slow.*	

Signature .....

Date ..... Time .....

Para. (6) is meant to convey the degree of urgency with which fire is to be opened, and in which the position is to be occupied.

5. Each Battery Commander will be supplied with a number of G.P.O's Cards, and having decided on his course of action will fill in his G.P.O's card and deliver it to G.P.O. In the case of the B.C. being away from his battery he will order his spare horse holder to convey the card to the G.P.O. (for outdoor schemes only).

In indoor schemes the rough position for the guns will have been chosen from the map.

G.P.O's Card.

(1) I am reconnoitring Gun Position for ..... guns at ..... facing approximate bearing ..... to cover attack—retirement —bombardment.

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(2) B.C's Party, (1) & (2), G.P.O., B.S.M., "A" Group join me at .....

(3) B.L. to lead Battery direct to ..... or to rendezvous at .....

(4) Brigade Headquarters at .....

(5) Ammunition .....

(6) Fast—Medium—Slow.

.....Signature.

.....Time.

6. On receipt of his card the G.P.O. will normally be with the battery and will proceed to carry out the directions ordered by the B.C. and will despatch to him the personnel he requires. (In outdoor schemes he may have had to accompany the B.C. to the battery position, in which case he will have issued preliminary orders for the forward move to the B.L. on the B.L's card and a second one issued later with the battery position more accurately defined if this is necessary.

In para. 2 of the G.P.O's card the B.C's party is divided up into (1) and (2).

B.C's party—(1) includes the B.C's H.H., B.C's Assistant, B.C.A's H.H., which men it is presumed the B.C. will always have with him, when away from the Battery. It gives him a spare Horse Holder (the B.C.A's and N.C.O. i/c Signallers' H.H.) to convey messages. Total 3 men.

(2) includes N.C.O. i/c Signallers, G.P.O's Assistant and H.H. for G.P.O's Assistant. Total 3 men.

If the B.C. does not require any of the personnel detailed in para. (2) of the G.P.O's Card, he will delete the names of those he does not require.

7. The B.C. will now proceed to the O.P. end of room with the object of carrying out his reconnaissance. He will therefore leave the gun position.

The object of this is to approximate the conditions in the field and sever the verbal communications between the B.C. and the battery. Any further orders must now only be sent over the telephone to be set up between the O.P. and gun position by the N.C.O. i/c Signallers and the 2 Telephonists.

At the O.P. end will be situated the Artillery Map and the Artillery minature range and director, range tables and cards with sequence of orders and formulæ and recorder's forms for the B.C's assistants.

8. The G.P.O. having obtained the necessary information, he will issue orders to the B.L. and fill in the B.L's card which he will hand or send to him.

He will then supervise the setting up of the G.P.O's director and telephone, assisted by the N.C.O. i/c Signallers, and get ready to

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receive orders from the B.C. The G.P.O's Assistant will use the Recorder's Form, A.F. B.82-2.

If he has not already done so, and then only if necessary, the G.P.O. will then proceed to the B.C. in the O.P. for orders, and when dismissed will return to the gun position and select on the map the accurate gun position, marking the position of the flank guns on the Sand Table with two red-flagged pins.

B.L's Card.

Orders to Battery Leader from G.P.O. by B.S.M.

(1) Target .....
(2) Position is OPEN. SEMI-OPEN. UNDER COVER.
(3) Battery Position will be ..... or Co-ordinate.
(4) Occupation. Flank. Independent. Line.
(5) Ground is easy, difficult; gun in travelling position, (for 60-pounders only).
(6) I will be on Right. Left. Flank.
(7) No ..... Ranging or R.C.L. Ranging.
(8) Fast. Medium. Slow.

.....Signature.
.....Time.

The B.L. will study the situation conveyed to him by his card, using the map, and the Sand Table (showing the gun position and approaches) and write out every order he would give to the battery from "Prepare for action" up to the moment of the battery coming into action.

When the B.L. has read his card, the B.S.M. will take it on to the battery captain.

9. When the B.C. is ready, the supervising officer will point out the 1st target to be engaged, both on the map and on the Artillery Range.

B.C., assisted by the B.C's Assistant, will fill in the sequence of orders and will cause them to be transmitted to the gun position over the telephone.

SEQUENCE OF ORDER CARD.

Sequence of Orders.

1. Target.
2. Ammunition H.E. or Shrapnel. Fuze ( ) N.C.T. ( ) Charge.
3. Line of Fire ( ) degrees R. or L. of { Zero Line. / Aiming Point. } or Direct Laying. Ref. Point ( ) o'clock ( ) degrees.
4. Deflection ( ) min. R. or L. (for Wind or movement of Target).
5. Concentrate ( ) min. on ( ) or Distribute ( ) min. from ( ).
6. Angle of Sight min. Elevation or Depression.
7.
8. Right Centre or Left Ranging or All Guns Ranging or No. ( ) Ranging.

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9. Interval seconds (normal 5 seconds).
10.
11. Elevation degrees minutes.
(G.P.O. reports to B.C. when ready to fire).
12. Fire.

10. The battery Captain will choose the position for the first line and write out the orders accordingly. He can then proceed to the O.P. and help to criticise the conduct of the firing carried out by the B.C.

He must take note of the number of rounds fired, in order to be in a position to replenish ammunition from the first line.

The whole work at the gun position must be supervised and criticised by the supervising officer.

11. The B.C. can now fire a practice series, using the Artillery Miniature Range, orders being passed down to the Gun Position.

12. If sufficient officers are present to form a second battery staff, another B.C. may exercise the second staff on the lines indicated above, taking over from the first B.C. when that officer has completed the series allotted to him.

It is advisable that the targets to be fired on should be communicated to the second B.C. a few minutes before the first B.C. has finished his last series, in order to avoid delay.

Each detail should be strictly enforced, such as the writing out of orders by all concerned, so that records are kept and can be criticised by the Supervising Officer.

OUTDOOR SCHEMES.

13. The routine laid down for indoor schemes can be equally and more usefully applied to outdoor schemes. The fact that they have previously been carried out indoors is a considerable help to the smooth working of the scheme out of doors.

In this case the armlets mentioned in para. 4 are absolutely essential.

Cards should be filled in in just the same way.

The filling up of these cards, should not take much longer than giving out orders verbally. Further there cannot afterwards be any question of a certain order having been given, forgotten, or it not having been correctly heard, if once committed to writing.

In the event of there being a subsequent criticism of the scheme or series the cards showing orders given and their sequence should be an assistance to the officer criticising the conduct of the series.

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INFANTRY ARTILLERY WEAPONS.

BY K. F. ADAMSON.

Reprinted from "Army Ordnance," Nov.—Dec., 1922. The Journal of the Army Ordnance Association (U.S.A.).

A SHORT time after the Armistice the Ordnance Department was authorized to proceed with the design and manufacture of a cannon for use by the Infantry which would function both as an anti-tank gun and as a weapon to replace the 3-inch Stokes mortar. The basic requirements were that it should fire an armour-piercing shell through one inch of armour at 500 yards and that it could be used for plunging fire at angles greater than 45 degrees for ranges from 400 to 2,000 yards, while the complete unit was required to be sufficiently mobile to accompany the infantry at all times either for draught on its wheels or by carrying.

After numerous studies, the infantry howitzer, model of 1920, was designed and built. The carriage of this unit was so constructed that it would mount a 1·8-inch, 25-calibre gun firing a 3-pound shell at a muzzle velocity of 1,450 feet per second, or a 2·24-inch howitzer of -13·3 calibre length firing a 6-pound high explosive shell at a muzzle velocity of 700 feet per second. In the trials of this unit, it was found that the armour-piercing requirements were fulfilled when using the 3-pound shell, but trouble was experienced in getting 1·8-inch high explosive of 4·5-pound and 5·6-pound to fly true with the resulting tendency to land on their base. The 6-pound high explosive shells in the 2·24-inch howitzer were reasonably satisfactory, but as these did not have the capacity of the 3-inch Stokes mortar shell, an effort was made to utilize 8-pound and 10-pound shells, which were unsatisfactory for the same reason as the heavy 1·8-inch.

Much valuable time was lost in attempting to make this unit give high velocity for armour-piercing conditions, and low velocity for the plunging fire at short ranges, and so, after rather exhaustive tests, it was recognized that the solution was fundamentally wrong, and consequently the unit was discarded.

Approval was recently granted to change the specifications of the infantry material to permit the design to two weapons; one to be used for anti-tank work and for firing against small known targets, and the other to be used for plunging fire against personnel or where a Stokes mortar shell would normally be used. The additional requirements for these weapons were laid down along the following lines: that the unit could be carried by man; could be drawn on the road; could be carried on pack animals or transported in trucks. In addition, no component part could weigh more than 75 pounds and the complete

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unit should not appreciably exceed 300 pounds in weight, while other characteristics desired were that the dissembling into its component parts should be done without the use of any but the simplest tools, and that the time consumed be only a few seconds.

With these requirements in mind, the Ordnance Department has recently designed and built wooden models of the following weapons: a 37-mm. gun, a 2·24-inch infantry mortar, and a 75-mm. infantry mortar. These are described in detail in the following discussion, with photographs and illustrations of the wooden models.

37-mm. Gun and Carriage, Model of 1923.

This gun and carriage is illustrated in Figure 1, which shows it in firing position for maximum elevation, while Figure 2 illustrates the four loads into which the complete unit can be broken up for man pack.

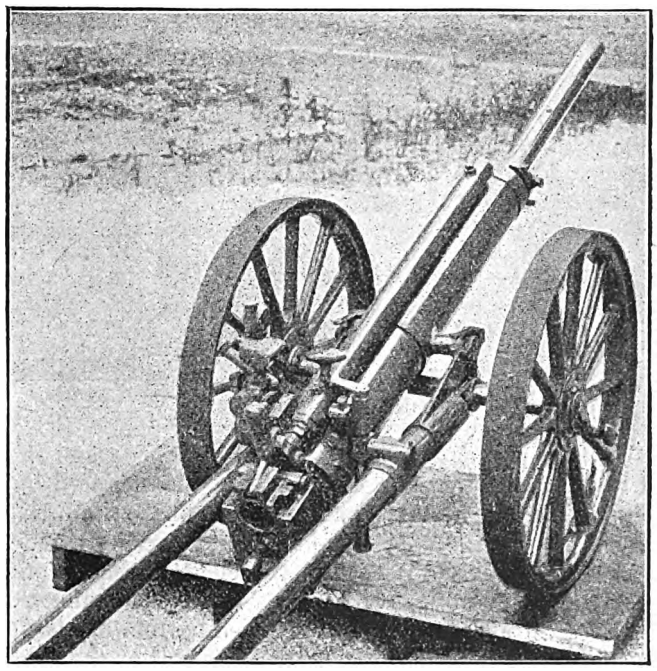

Fig. 1.

The gun consists of a single layer tube to which is threaded the breech ring containing a drop sliding block. The firing mechanism consists of a hammer operated by a lanyard which strikes the firing pin, the design being similar to that on the 155-mm. howitzer, model of 1918. The front end of the gun tube has spline keys formed integral with it, which prevent the rotation of the gun during recoil, as well as guide it into battery during counter recoil. Slightly to the rear of these keys there is a short length thread which is slotted to engage a nut in the cradle, thus locking the gun to the cradle.

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The carriage consists of the cradle, trail, axle and wheels. The cradle is a steel cylinder housing the sleigh and counter recoil spring. The recoil cylinder is secured to the steel cylinder and consists of a piston rod with a throttling valve in the piston head. A helical counter recoil spring is enclosed in the steel cradle cylinder and surrounds the gun. The steel cradle is designed to support the gun on bronze rings at each end, while felt washers are provided to keep the bearing surfaces of all recoiling parts clean.

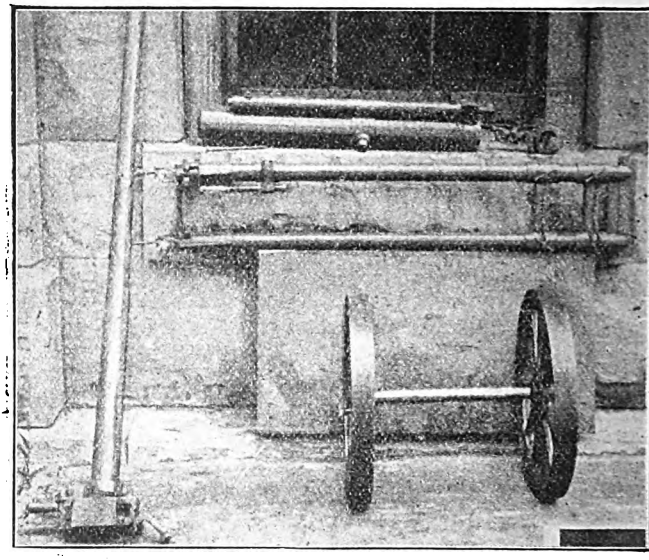

Fig. 2.

The elevating gear is a screw on the right side and is pivotally attached to the trail and cradle. This screw is operated by a crank located at the top which permits an elevation of from minus 5 to plus 20 degrees. Due to the possible injury of the serving personnel, this design has been changed by locating the elevating screw on the left-hand side, but its operation will not be appreciably affected. The carriage has axle traverse, which is obtained by rotating the axle by a crank on the outside of the wheel. Square threads on the axle meshing with suitable bushings in the trail give a translating effect when the wheels are held rigid. The trail is built of steel tubes with a casting at the rear end for the spade and two at the front end to support the cradle trunnions on the one side and the axle bearing on the other. These trail tubes telescope so that it can be used at full length when stability is required at zero degrees elevation.

It is anticipated that this gun will fire a 1·25-pound shell at a muzzle velocity of 2,000 feet per second, which is sufficient to penetrate one inch of armour at 500 yards. The range at its maximum elevation of 20 degrees will be in excess of 5,000 yards, which is greater than can normally be utilized by a weapon of this type. The component loads of the gun tube, cradle, trail, and axle with wheels do not exceed 75

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pounds in the original design, although it is anticipated that the last-mentioned unit will be increased slightly to ensure excess strength when drawn on the road by animals.

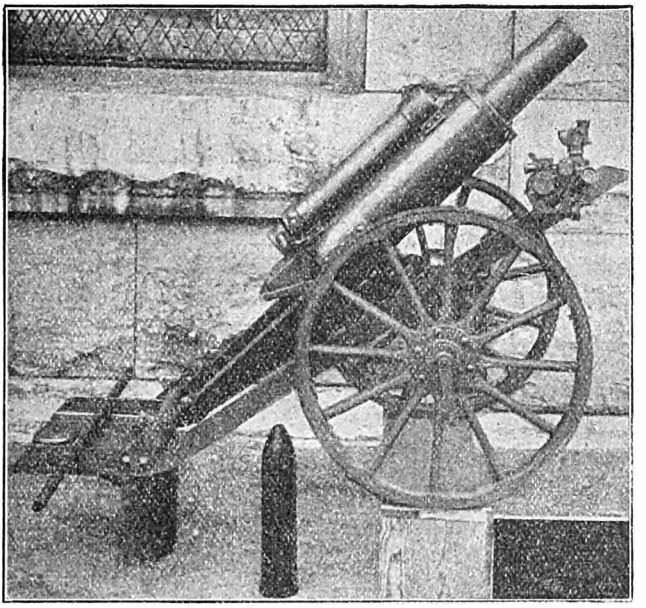

Fig. 3.

The following procedure is necessary to disassemble the unit into its four component parts: First, remove the pin connecting the piston rod to the gun lug, after which the locking nut at the forward end of the cradle is rotated, disengaging the tube from the counter recoil spring. The gun is now free, and is removed from the cradle by sliding to the rear. Second, lift the latch handles over the trunnion caps and rotate them forward thus releasing the trunnion caps and axle bearing caps. The elevating screw is then disengaged from the cradle, after which the cradle may be lifted off of the trunnion bearings, and the trail lifted from the axle.

A comparison of the 37-mm. gun, model of 1916, and the 37-mm. gun, model of 1923, is given in the following table. From this comparison it will be noted that the muzzle energy per pound of the unit has been increased over 200 per cent in the new design over the model of 1916:

	37-mm. Gun.	
	M. 1916	M. 1923
Length of gun in calibres	19.94	39.5
Weight of projectile, lbs.	1.234	1.25
Weight of charge, grains	500	1,400
Max. powder pressure, lbs. sq. in.	18,500	20,000

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Muzzle velocity, ft. per sec.	1,276	2,000
Muzzle energy, ft. tons	13,945	34,703
Weight of gun, lbs.	56	75
Muzzle energy per lb. of gun in ft. lbs.	557.8	1,387.8
Ratio	1	2,488

	37-mm. Gun Carriage.	
	M. 1916	M. 1923
Diameter of wheels	37.75	24
Width of track	33	21.5
Overall length of vehicle	75	140
Overall height of vehicle	37.75	26.5
Overall width of vehicle	57	26.5
Weight of gun and carriage	360	300
Muzzle energy per lb. of unit in ft. lbs.	86.0	263.0

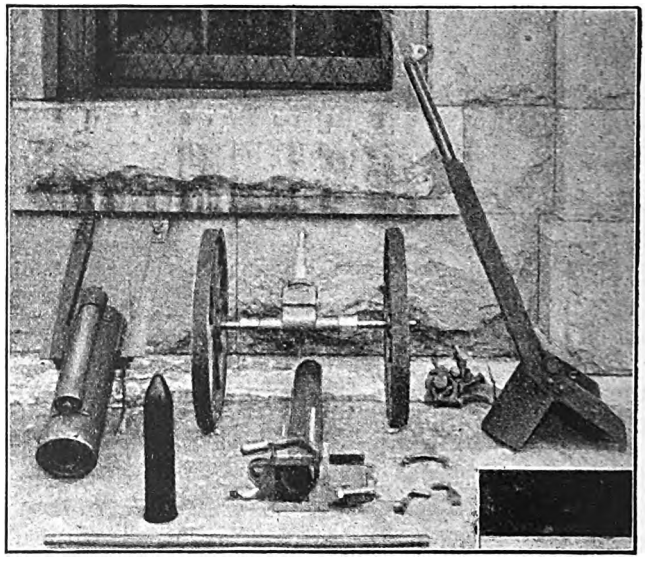

Fig. 4.

75-mm. Infantry Mortar and Carriage, Model of 1923.

The 75-mm. Infantry mortar and carriage, model of 1923, is shown in Figures 3 and 4, the first illustrating the mortar in firing position at its minimum elevation of 45 degrees, while the other shows the complete unit broken up into the component parts for man packing.

The construction of the cradle and gun tube are of a similar design to that described for the 37-mm. gun, except that the force of recoil is transmitted by suitable angles directly to the spade, thereby relieving the carriage proper of all firing loads.

The sight was originally placed on the right trail angle at a comfortable height for a man seated on the ground, as shown by the illustration, the trail being extended beyond the sight to protect it from

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damage should the carriage be tipped during travelling with the sight in position. This feature of the design, however, will be changed in the finished material, as it was an unnecessary refinement, and the sight will be located on the angle iron, which is attached to the recoil cylinder.

The elevation of this mortar is obtained by the use of a differential screw action between the recoil housing and the axle, the amount of elevation varying from 45 to 70 degrees. The traverse is obtained by rotating the axle in the wheels by the use of a suitable crank, which translates the entire top carriage about a pintle to which is fixed the spade. This feature has been introduced because of the tendency of the wheels to slide normal to the line of fire when traversing the mount.

2.24-Inch Infantry Mortar and Carriage, Model of 1923.

The 2·24-inch Infantry mortar and carriage, model 1923E, are of the same general design as the 75-mm. infantry mortar and carriage, with the exception that the pivoting spade has been eliminated, as it is believed that on the small spade necessary, there will not be sufficient ground resistance to cause the wheels to slide laterally. The final test alone can show the correctness of this assumption.

In the dismantling into the four component loads of the two above described weapons, the following procedure is necessary: First, the two taper pins are withdrawn from the cradle strut forks and trunnion bar. The cradle containing the cannon is then balanced horizontally upon the elevating mechanism, after which the front ring in the cradle is turned by means of a special spanner wrench, which unlocks the gun from the cradle, and the pin withdrawn, which disconnects the recuperator piston rod from the breech ring. The mortar tube is then withdrawn to the rear, and the cradle lifted off the elevating mechanism after the disconnection of one additional pin.

The trail is disconnected from the axle by merely rotating it through 90 degrees, after which the axle can be disengaged, due to the nature of the special joint used.

Projectile	2.24″ Inf. Mortar, M. 1923E	75-mm. Inf. Mortar, M. 1923E
Weight of Shell, lbs.	6	12.12
Length of Case, inches	2.88	3.08
Length of Assembled Round, inches	11	12.6
Case Capacity, cu. in.	4	8
Charge weight, lbs.	.037	.07

Muzzle Velocity with	2.24″ and 75-mm. Infantry Mortars, M. 1923E ft. sec.
1st Zone	450
2d Zone	395
3d Zone	350

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4th Zone	310
5th Zone	275
6th Zone	245
Max. pressure in chamber	12,000 lbs. per sq. in.

	65°	45°
1st Zone	1,450	1,850 yds.
2d Zone	1,158	1,480 yds.
3d Zone	910	1,170 yds.
4th Zone	720	930 yds.
5th Zone	570	740 yds.
6th Zone	450	590 yds.

Zone Overlap min.	20 yds.
Length of recoil	10 inches
Type of recoil	Hydro-spring
Elevation of gun	45° to 65°
Total traverse (axle)	10°

General Characteristics.	2.24″ Inf. Mortar M. 1923E	75-mm. Inf. Mortar M. 1923E
Weight in firing position, lbs.	220	285
Diameter of wheel, inches	24	24
Width of wheel, inches	2	2
Ground clearance, inches	9	9
Gage, C. to C.	22	22
Weight of gun, lbs.	55	75
Weight of cradle, lbs.	60	70
Weight of trail and spade, lbs.	45	70
Weight of wheel, axle and elevating mechanism	55	65
Weight of sight, lbs.	5	5

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THE TECHNICAL TRAINING OF ARTILLERY OFFICERS.

BY LIEUTENANT-GENERAL H. ROHNE, GERMAN ARMY.

(Abridged Translation from "Artilleristische Monatshefte," May-June, 1919, by Colonel O. L. Spaulding, General Staff, U.S. Army).

Reprinted from "The Field Artillery Journal," May-June, 1921.

IN an article published in October, 1913, I said that the lack of encouragement of technical study by our officers had caused our artillery to fall behind the French. This assertion caused an active controversy. A few months later the war broke out, and showed clearly that the French were ahead of us, not only in armament, but—what was more serious—in their handling of it. Our field artillery did hold its own, partly on account of the superiority of our heavy artillery, but also because it learned rapidly, and the French advantage gradually diminished. During the war, on account of the censorship, it was impossible to discuss the matter; but it is of importance to the development of our arm, and deserves careful consideration.

Prussian artillery officers seem always to have been behind those of other German states in scientific attainments; Scharnhorst expressed himself to this effect even before 1790, after visits to all the states. He was then in the Hanoverian service; but his criticisms seem to have led Frederick William II to found his "Military Academy for Artillery," which was opened in 1791 but was broken up at the outbreak of war in 1806. Scharnhorst was transferred to the Prussian artillery in 1801, but had no direct influence on the training of artillery, since he was assigned as director of instruction for young infantry and cavalry officers. The theoretically trained officer had to encounter strong prejudices of the "practical soldiers," who insisted that any good non-commissioned officer was of more value.

After Jena, the task of reorganizing the army fell to Scharnhorst. One of his ideas was the establishment of the Artillery experiment Commission in 1809; this made it possible for a junior officer to get suggestions considered.

In 1816, upon recommendation of Prince August and General v. Rauch, the Inspectors General of Artillery and Engineers, the "Artillery and Engineers School" was established. This school was intended to give officers of these arms not only their special technical instruction, but also that general military education which infantry

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and cavalry ensigns secured in their divisional schools. Unfortunately, the course of instruction was not well planned, and gives the impression that less thought was given to the officers who were to serve the guns than to those who were to make, issue, and care for them. Thus tactics was excluded from the course of instruction, and that with the approval of the Artillery Experiment Commission! On the other hand, not less than thirty hours a week were devoted to instruction in drawing of all kinds, including mechanical and topographical. The reason for this appears to have been that the drawing instructor, Captain Burg, was an exceptionally good man, and enjoyed the high favour of Prince August, while the instructors in the more strictly military subjects were hardly above average. But artillery officers gradually became a class apart from others, and the arm itself came to be considered as secondary.

The methods of instruction were not satisfactory; Prince August tried to introduce applicatory methods, but was unsuccessful on account of the expense involved. In 1830 Major v. Radowitz secured the introduction of tactics into the course, but with only three hours per week allotted. Naturally, the young officers took but little interest in subjects that seemed to be considered as unimportant for their profession.

From 1854 to 1872 General v. Peucker, a highly trained artillerist, was Inspector General of Training. He had noted that the Artillery and Engineer School was not getting results equal to those of the War Schools; and in 1865, after the retirement of General v. Hahn (who, as Inspector General of the Prussian Artillery, had opposed the introduction of rifled guns, and minimized the importance of the technical training of officers), succeeding in establishing the policy that candidates for artillery commissions should go to the War Schools, as in the other arms. The course at the Artillery and Engineer School had been three years for all officers; after 1868 this was reduced to one, only a few specially selected officers being retained for advanced courses. It thus became possible to give a better course to these advanced students, and one year was found sufficient for officers seeking line duty.

General v. Hindersin, who succeeded v. Hahn in 1864, encouraged scientific work by artillery officers in every way. He had the best of the routine studies prepared by officers of all grades sent to him, and published the names of the authors. He also made it a point to attend the conferences of the Guard artillery officers, which were held every two weeks; this alone was enough to stimulate officers to take part in them. He required officers to study the artillery of foreign powers, and made the results of these studies available to all. One might say that this could be done better and with less trouble by the Experiment Commission or by the General Staff; but his idea was to arouse the interest of all officers, and for this purpose he thought it best to encourage them to do the work themselves. Unfortunately, his successors did not carry on this idea, and the result was that our officers went into the war with a positively horrifying

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ignorance of the enemy's methods. Hindersin's greatest achievement, however, was the establishment of the School of Fire, which directed the attention of officers to the prime mission of their arm shooting.

He was not at all satisfied with the work of the Artillery and Engineer School, and did not hesitate to say so. From my own experience I can say that Captain Roerdansz, later Inspector General of Foot Artillery, was the only instructor who roused real interest in his students, by calling for original work from them. He insisted upon the introduction of applicatory methods, but unfortunately this recommendation was not approved by General v. Podbielski, who had succeeded General v. Hindersin as Inspector General, and the new method was introduced for the first year course only.

About this time an important change was made, which had long been desired by almost all artillery officers—the definite and complete separation of the Field and Fortress Artillery. The improvements in material had greatly increased the requirements as to technical knowledge, and it was felt that the average officer could not be expected to have the necessary familiarity with all the numerous types and classes of weapons, requiring different management. It was also hoped that the field artillery could be brought into closer relations with the infantry and cavalry. These expectations were fulfilled in part only. The Foot Artillery, as the Fortress Artillery was now called, profited decidedly, its officers making great improvement both theoretically and practically; but the Field Artillery failed to do so. The Foot Artillery laid stress upon effect; the Field Artillery upon mobility. The strange result was, that the Field Artillery, an arm which can fight only at a halt, received drill regulations closely resembling those of the cavalry, which fights only in motion.

But technical training came to be more and more neglected in the Field Artillery, and in about 1889 attendance at the Artillery and Engineer School by officers of that arm ceased entirely; they received only a four months' course of instruction at the School of Fire at Jüterbog. This was well enough to prepare young officers for duty in the regiments, but could not be considered as adequate for all purposes. This was soon recognized; but instead of renewing the requirement that all lieutenants should go to the Artillery and Engineer School, an order issued in 1896 granted admission to only thirty, voluntarily applying for a one-year course. In 1897 a second-year course was added, for twenty selected officers.

In 1906, this school was consolidated with the Technical Military Academy. Attendance at this school for at least a year was compulsory for lieutenants of Foot Artillery, but for Field Artillery and the other arms optional. The number of volunteers was small, and the influence of the school upon the service at large was slight.

The other States of the Empire paid more attention than did Prussia to the technical instruction of artillery officers. Bavaria had a separate artillery school, and maintained it up to the beginning of the war. As illustrating the backwardness of Prussia and of the Field

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Artillery in particular, it is interesting to note that between 1875 and 1908 six successive presidents of the Experiment Commission were officers of the Foot Artillery; and three between 1890 and 1903 had received their training in Hanover and Bavaria.

Since private industry has become interested in the manufacture of war material, an officer is seldom called upon to design guns and other equipment himself; but he must have enough technical training to insure that his demands are not unreasonable, and to enable him to pass a sound opinion on designs submitted. He should be able to judge whether a suggestion received is worthy of test; often suggestions are made which rest upon false assumptions, or contain nothing new, and one must be thoroughly familiar with the subject in order to decide. Again, it is a matter requiring expert knowledge to arrange the details of a test, so that the result may be attained with the minimum expenditure of time, energy, and money.

Every test is a question asked of Nature, who always gives the right answer; but one must put his question in proper form, and must be able to understand the answer—which implies sufficient knowledge to observe with the mental as well as the physical eye. And every observed phenomenon must be considered in connection with others.

The empiric does not discriminate as to the degree of reliability of his observations; but this is necessary. For example, in firing for the construction of range tables, after allowing for the error of the moment there will still remain some uncertainty as to the initial velocity, range, dispersion, etc.; and the number of rounds to be fired must be fixed with regard to the degree of accuracy required in the results, and also with regard to the ranges in question.

The instructor at the School of Fire should have in mind not only the instruction of his students, but also the progress of the art. He should realize that a bracket is not absolutely reliable, but should understand the effects of dispersion and of uncertainties of observation. It is easy to show that a bracket determined by only one shot at each limit is uncertain, and often requires verification. In almost all countries except Germany the regulations require two clearly observed shots at each limit.

Simple firing methods and early effect are desirable. This can be attained only if one applies the rules of fire intelligently, instead of following them slavishly; and this implies that one understands his rules thoroughly, and that the regulations leave him sufficient freedom. Thus, to cover an area uniformly, range changes of 1·75 times the mean dispersion are sufficiently small. In service firing the dispersion will be 50 per cent. or 100 per cent. greater than the range tables show; range changes of 50 metres should then suffice, and it is certainly simpler to use only the fifty's and not the twenty-five's. With time shrapnel, the greater depth of the cone of dispersion makes hundred metre changes sufficient. All foreign regulations recommended the larger changes. And so the very theory which the "practical soldier" affects to despise tends to simplify firing methods.

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The indisputable superiority of the French field artillery over ours at the beginning of the war is due in no small part to the better mathematical and scientific training of their higher officers, who are mostly graduates of the Ecole Polytechnique. To name only a few of the officers who have specially distinguished themselves in technical work, one thinks at once of Charbonnier, Vallier, Gossot, Lionville, Jacob, and, perhaps most conspicuous of all, Percin and Langlois. These two generals had to a marked degree the talent of inspiring others to independent work, as for example Bourguet, Rouquerol, LeRond, Challéat, Aubrat, Maillard and Palocque.

In many technical matters the French artillery was far ahead of the German; they were the leaders in the introduction of the combination fuze, smokeless powder, high-explosive shell, the rapid-fire gun, and the independent line of sight. They were the first to appreciate the advantages of the sharp-pointed projectile and of the boat-tail. They quickly recognized the influence of the new discoveries upon artillery organization and tactics, and decided upon covered positions and indirect fire, when the Germans hesitated. They reduced the battery strength to four guns, rightly judging that a few guns with ample ammunition were worth more than many guns with scanty ammunition. They solved the difficulties of calculating deflections and clearing the mask. They laid stress upon opening fire by surprise, and upon early effect; they recognized that this generally excluded accurate adjustment, so systematized fire upon a definite zone. They were ahead of us in adjustments with time fuzes.

The war clearly demonstrated the value of theoretical study of practical firing problems. In recognition of this, many scientific men, teachers in civil institutions were called into service by the Experiment Commission. They calculated our range tables for fire upon aircraft; devised methods for determining the error of the moment, and for facilitating adjustment; worked out the process for sound ranging, and for high-burst ranging. Incidentally, it may be noted that this last-named procedure was known to the French twenty years ago (*Revue d'Artillerie*, July, 1899, p. 303). The war numbers of the *Artilleristische Monatshefte* are full of articles from these men. And their work is not yet ended; but I may confidently assert that many important ballistic problems have been solved by German scientific men, and that many more advances will be accomplished through them.

The German foot artillery, whose officers had all attended the army technical schools, was better instructed technically than the field artilery. Since at the beginning of the war it also possessed a great superiority over the enemy in both men and material, its success was immediate and conspicuous.

Germany's future army will certainly be much smaller and the term of service shorter; it is, then, all the more necessary that the officers' training be of the highest. Our private industry will provide us the best of weapons, in the future as in the past. The officers must be prepared to decide upon the requirements which the weapons are

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to satisfy, determine whether these have been satisfied, suggest improvements, devise regulations for their use, and train the troops accordingly. This means an officers' corps with a high grade of education. To secure this, I believe the following things are necessary:

1. No one should be accepted as a candidate for an artillery commission without a thorough grounding in mathematics. The officer on duty with troops may not have to deal with abstruse mathematical computations, or even with extended numerical calculations. But he must be able to think mathematically, and to read an elementary discussion of ballistic questions. Without this knowledge, one may slavishly follow the rules of fire, but can not use them freely and intelligently, because they will not be understood thoroughly. If anything goes wrong, one is entirely at sea. Until recently, a candidate was required to make an examination mark in mathematics of at least "fair"; this requirement has been dropped, although the use of modern weapons demands more and not less. Properly, the requirement should have been raised, making the minimum "good." Without this, one can not properly train his non-commissioned officers and gunners. With the shorter service, these men cannot depend upon memory alone, but must solve their problems by reason.

2. Every artillery officer must have a solid technical training. To this end, the best means would be a one-year course at a special artillery school, where theory and practice should go hand in hand. The teachers would have to be very carefully selected; this point will be further considered below.

3. Specially qualified officers should be given the opportunity for higher technical training. With the reduced strength of the army, it is doubtful whether it would be possible to maintain a separate institution; if not, it should be made a part of the technical school at Charlottenburg, special courses being instituted; as, for example, at the Zurich Polytechnic, where there are officers among the instructors. The courses should cover several years, and include exterior and interior ballistics, gun construction, mathematics (differential and integral calculus, mechanics, probabilities, etc.), physics, chemistry (especially in military applications), practical laboratory work, and foreign languages if desired. Passage to a higher course should be made dependent upon satisfactory completion of a lower; but the course should be so planned that any part of the course would be useful alone. There should be an entrance examination, as for the War Academy.

4. Formerly, the best of our officers sought assignment to the General Staff, because the prospects for advancement were better. But the work of an especially qualified officer may be of more value to the country as an artilleryman than as a general staff officer or an adjutant; men who are conspicuous in their own specialties should have the same opportunities for advancement as the general staff. More officers would then volunteer for technical schools. For in-

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structors at the higher military schools, for members of the Experiment Commission, for the School of Fire, and for posts in the Ministry of War dealing with artillery matters, officers with technical training should be sought. This has not always been the case.

5. The Experiment Commission should always have a "scientific section," as it had during the war. Not only will this help in the proper planning and conduct of experiments, but the association of officers and scientists will tend to breadth of view.

6. "Officers should be given opportunities for private study, and the necessary books must be made accessible to them. At one time each army corps area had its "artillery library," which contained a few of the most important books and periodicals, and which made them available in the officers' clubs. Later, a very few regiments possessed their own libraries. The higher authorities, if not actually hostile to the technical press, were at least indifferent and discouraging, perhaps because it sometimes contained criticism of existing institutions. It was natural, there fore, that even the best qualified officers hesitated to publish anything. Even the requirement that the articles should be submitted for approval tended to discouarge them. This will partly explain why it was that Germany, alone among military powers, had no artillery magazine from 1897 to 1906. Up to that time the place had been filled by the *Artillery and Engineer Archives*, which died in that year for lack of support, at the respectable age of sixty-two. I was myself editor of this paper in the '80's, and tried, but without success, to persuade regiments to subscribe for it at the very moderate rate of six marks a year!"

"For an officer who wishes to improve himself in his profession, there is no better method than to write for the magazines; since he thus invites criticism, he is compelled to work his questions out thoroughly. I believe it is highly desirable that all hindrances be removed from the way of the military press in future, and efforts made to stimulate it, by doing away with all exaggerated ideas of secrecy."

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

The Field Artillery Journal. Jan. Feb. 1922.

This number has as frontispiece a photograph 2 feet wide of the 11th Field Artillery Brigade—Motorized.

It also contains another instalment of the Operations of the Horse Battalion, 15th (German) F.A. with the 7th Cavalry Division in Northern France (which will be published shortly in our Journal).

Belgium.

Bulletin belge des Sciences Militaires.—April, 1922.

I. Operations of the Belgian Army. (Continued.)

III. Liaison and Infantry communications in battle. Cap. Comdt. Paquot.

V. Belgian and French Aviation on the Western Front. Cap. Comdt. Desmet.

VI. Time and Percussion Series—Material to enable imaginary series to be practised—with illustrations. Lieut. Durant.

A good deal of thought is being devoted to indoor practical gunnery and the miniature range.

VII. Review of recent Italian publications on ballistics (iii) L. Godeaux.

VIII. The Washington Conference. (ii). Cap. Comdt. Dendal.

IX. An application of directional wireless to laying guns. Col. Grade.

France.

Revue Militaire Francaise.—April, 1922.

Gen. Buat. Hindenburg and Ludendorff's campaigns on the Eastern Front. IV.

Lt.-Col. Fontaine. The crossing of the Vesle by the 10th Division —30th Sept. 1918.

Comt. Dumont. The military situation of to-day in Germany. (Concl.)

Revue Militaire Générale.—March, 1922.

Comdt. Toussan. On the Offensive of March 1918.

Lucius. The recasting of regulations and our war doctrine (VIII) —continuation of period reviewed in Jan. number.

Capt. Merat. One principle—One procedure. Economy of forces, and concentration on the principal theatre of war.

An interesting article. The author points out that the Napoleonic principle of concentrating your forces on the principal theatre of war

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lasted until 1912 when the Turks constructed the Tchataldja Lines. Tchataldja was regarded as an abnormal situation, and no more to be acted on as a guide to the use of defensive works in European war, than the war of Secession or the Russo—Japanese war.

Tchataldja actually marked the coming of the period of the *limited and inviolable front.*

The writer comments on the operations in the various theatres of war, and concludes that during the greater part of the Great War, the Napoleonic principle *could not* have been adhered to.

The principle was again acted on in 1918 when the enemy were able to concentrate on the Western Front, and as far as the writer can foresee, owing to the adoption of new engines of war which entirely alter the nature of battles the principle will again be applicable in future wars.

Germany.

Militär Wochenblatt.—28th January, 22.

The 27th January—a historical reflection by Lt. Gen. v. Altrock.

The writer calls upon the Germans to nurse the grand spirit of 1914 so that it "may wake again, grow and work wonders when the time comes."

The crisis in the Italian army in October 1917 by General v. Dellmensingen.

There has been considerable correspondence on this subject. It is held by many that the 14th Army lost a great opportunity in not swinging round its left southwards on reaching the Tagliamento, and capturing the whole of the 3rd Italian army. The writer defends Otto van Below on various grounds, the main point he makes being that the Austrian Corps on the left of the 14th Army flatly refused to allow the Germans to cross their front and even threatened to attack them if they attempted it.

The situation in the Far East.

Records recent fighting between the Bolsheviks and Russians in the far east.

Preparation of young Frenchmen and Belgians for Army Service.

Deals with the national scheme for the physical education of boys in preparation for military service.

4th February.

Ludendorff and the diplomats.

Von Bethman Hollweg in his war book passed some severe criticism on Ludendorff, and the latter has been writing a series of articles in the *Militär-Wochenblatt* defending his action and bringing various charges against the late Chancellor. This article is written by a supporter of Ludendorff and comprises his statements with regard to the German and Austrian conferences which took place early in 1917

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to deal with some supposed feelers for peace then put forward by France.

Position Warfare.

Deals with the bad moral effect and inevitable loss of discipline caused by trench warfare.

Fighting formations of infantry, by Capt. v. Frankius.

Discusses the training and tactical handling of sections and platoons.

The Anthropologist as an officer-hunter.

Dr. Steiner in his paper the "Hammer" has been apparently making a severe attack on German officers of the old school.

11th February, 22.

The destruction effected by us in France, by Gen. Ludendorff.

According to the writer no more damage was done than was required by the actual necessity of war. The blame for the demolition of towns and villages is credited to the allied artillery. In 1917 it was necessary to clear a field of fire 12-15 k.m. wide in front of the Hindenburg line.

The employment of poisonous gases in war.

It is claimed that the Germans only just forestalled the French in the use of gas in the war. A disbelief is expressed in the utility of international agreements for preventing it. It is thought that England would be the first to break faith in the matter.

Geography as a ground work for World Politics.

A review of a book on this subject by Arthur Dix.

The new French Commander-in-Chief.

Attention is drawn to the large powers now exercised by Marshal Pétain in his new post.

France is making tremendous preparations against England and America with the money she owes these two countries.

Various quotations are given with a view to supporting the statement in the heading.

No number of the *Militär Wochenblatt* is complete without a statement either that the French are making great preparations for a war with England using long range coastal guns and submarines as their principal weapons, or that the English have enslaved the Irish for centuries and have often deliberately engineered famines for them.

18th Feb. 22.

The populations of the European States and the strength of their respective armies, by Lt. Gen. v. Altrock.

The percentage of peace strength to head of population is given. Greece heads the list at 5.36, France comes next with 2.19, England is at .72 and Germany at .17.

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The geography of the Pacific after the Disarmament Conference. Discusses some of the effects of the Washington Conference.

The disintegration of the Russian army in the world war.

The Mistakes of Poland.

Quotations from an article by a Frenchman on this subject. subject.

25th February, 22.

Washington and the U Boat question, by Admiral von Grapow.

The writer says that Hughes' proposals were merely a piece of bluff organized by England and America to save themselves from unproductive expenditure. From the point of view of the relation of power the agreement makes no difference, but commercially it will be of particular benefit to England. Of course England will have to suffer an American fleet of equal size, but in spite of that, her rule of the sea is not endangered.

The U Boat decisions are then discussed and reasons are given why the 'Root' resolution can never be carried out. Finally it is stated that no rule of war will ever bind such an unscrupulous nation as England.

The French higher leadership, 1917-1918, by General von Kuhl.

A very interesting review of the recent book by Major Laure "Au bureau du Troisième G. Qu. G."

Crown Prince William on the restoration of Germany.

An explanation of the true meaning of the Crown Prince's letter of the 15th October, 1921.

Militär Wochenblatt.—4th March, 1922.

"*Ludendorff's picture of himself.*"

A review of a pamphlet under this title by Hans Delbruck. The proposer is exceedingly hard on his old enemy both as politician and as General—makes him responsible for most of Germany's evils and belittles his achievements at Tannenberg and elsewhere.

Poland and the Baltic States. October to December 1921.

An article devoted mainly to military and political conditions in Poland.

Reports on military and political matters in Switzerland.

Apparently the high value of the franc is doing Switzerland no good. Trade and agriculture are both at a low ebb and unemployment is rife. The army is full of keenness and is being helped by German lecturers. The Swiss think very poorly of the League of Nations and have no very kindly feelings towards France at present.

The French Troops in Morocco.

New methods of Infantry Training, by Capt. v. Frankius.

Worth reading. The offensive spirit must be instilled into the individual. So it is with discipline which must now be self discipline towards which 'Sport' will be found a great help.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

With the Battle Cruisers. By Filson Young. London (Cassell) 1921.

The Crisis of the Naval War. By Viscount Jellicoe. London (Cassell) 1920.

The Grand Fleet, 1914-16 : Its Creation, development and work. By Viscount Jellicoe. London (Cassell) 1919.

A Naval History of the War, 1914-18. By Henry Newbolt. London (Hodder & Stoughton).

The Navy in Battle. By A. H. Pollen. London (Chatto & Windus) 1918.

The Dover Patrol. The Straits : Zeebrugge : Ostend. By J. J. Bennett. London (Grant Richards) 1919.

My Reminiscences in East Africa. By Genl. von Lettow-Vorbeck. London (Hurst & Blackett).

London Gunners : The Story of the H.A.C. Siege Battery in Action. By W. R. Kingham. London (Methuen) 1919.

The Adventures of Dunsterforce. By Major-Genl. L. C. Dunsterville. London (Arnold) 1920.

With the British Army in the Holy Land. By Major H. O. Lock. London (Robert Scott) 1919.

The Origins of the War. By Raymond Poincare. London (Cassell) 1922.

The Expansion of Europe : The Culmination of Modern History. By Ramsay Muir. London (Constable) 1922.

Imperial Military Geography. By J. FitzGerald Lee. London (Clowes) 1922.

A Short History of British Expansion. By James A. Williamson. London (Macmillan) 1922.

The Military Map : Elements of Topography. By Gerald Maxwell. London (Macmillan) 1918.

Topography and Strategy in the War. By D. W. Johnson. London (Constable) 1918.

Seaways of the Empire. By A. J. Sargent. London (Black) 1918.

History of the British Empire. By C. S. S. Higham. London (Longmans, Green) 1921.

The Encyclopædia Britannica, Volume 30. (First of the three additional volumes to the eleventh edition).

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REGIMENTAL LIST. The following Postings have occurred during the period 16th March, 1922, to 15th April, 1922.

Postings.—R.H. and R.F.A.

Armytage, Capt. H. W. H., M.C., from Adjt., 31st Bde., to Att. IV. Res. Bde. 1/4/22.
Athill, Major L. F. I., from Att. 16th Bde., to 8th Batty. 1/4/22.
Biddlecomb, Lieut. S. C., M.C., from R.T.O. Ireland, to Att. 4th Bde. 18/3/22.
Bingham, Lieut. H. F., from 83rd Batty., to 19th Bde. 21/3/22.
Bishop, Capt. C. B. J., M.C., from 1 Depôt, R.F.A., to 27th B.A.C., India. 14/3/22.
Bowring, Lieut. J. R., M.C., from IV. Res. Bde., to 19th Bde. 21/3/22.
Congreve, Major F. L., D.S.O., M.C., from 45th Batty., to Att. IV. Res. Bde. 1/4/22.
Cooper, Major G. S., D.S.O., from 67th Batty., to Att. IV. Res. Bde. 3/4/22.
Digby, Lieut. H. A., from Att. R.A.O.C., to Att. IV. Bde. 13/4/22.
Drummond, Capt. C. A. F., O.B.E., from 132nd Batty., to Adjt. Oxford & Wor. (Yeo.) Bde., T.A. 10/4/22.
Gordon, Major J. K., D.S.O., from 129th Batty., to Att. IV. Res. Bde. 5/4/22.
Glynn, Capt. R. T. W., M.C., from 78th Batty., to Att. 1st A.A. Bde., R.F.A. 24/3/22.
Hayley, Major W. B., D.S.O., from IV. Res. Bde., to 2nd Batty. 1/4/22.
Herbert, Lieut. F. W., from 23rd Bde., to Att. II. Res. Bde. 25/3/22.
Hollwey, Capt. Jas. B., M.C., from 17th Batty., to Att. IV. Res. Bde. 1/4/22.
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Hutchison, Major (Bt. Lt.-Col.) H. O., D.S.O., M.C., from Unposted, to Att. IV. Res Bde. 3/4/22.
Jephson, Lieut. E. W. F., M.C., from Unposted, to Att. 4th Bde. 5/4/22.
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Knolles, Major R. M., D.S.O., from 91st Batty., to 44th Batty. 1/4/22.
Knox-Peebles, 2nd Lieut. W. C., from 83rd Batty., to 19th Bde. 21/3/22.
Myburgh, Capt. P. S., D.S.O., M.C., from Adjt., 23rd Bde., to R.A. Training Centre, India. 21/2/22.
Powell, Lieut. S. G., M.C., from 34th Bde., to 19th Bde. 21/3/22.
Ritchie, Capt. H. G., from 98th Batty., to 13th Batty. 21/3/22.
Scarlett, Lt.-Col. J. A., D.S.O., from 2nd D.A.C., to 1st D.A.C. 24/3/22.
Seagrim, 2nd Lt. C. M. D., from 1st Batty., to 5th Batty. 10/4/22.
Sebag-Montefiore, Major T. H., D.S.O., M.C., from "L" Batty. R.H.A., to Unposted. 10/4/22.
Sheil, Lieut. W. A., from 1st Batty., to H.Q., 37th Bde. 10/4/22.
Smith, Lieut. D., from Unposted (Russian Course), to 15th Bde. 10/4/22.
St. Clair, Major G. J. P., D.S.O., from 44th Batty. R.F.A., to "L" Batty. R.H.A. 10/4/22.
Taylor, Lieut. J. D., M.C., from 14th Bde., to 19th Bde. 10/4/22.
Vining, Lieut. F. E., O.B.E., from Att. 4th Bde., to 4th Batty. 28/3/22.
Wales, Lieut. H. J. H., M.C., from Att. I.O.D., to 109th Batty. 18/3/22.
White, Major J. L. C., M.C., from 15th Batty., to Att. IV. Res. Bde. 1/4/22.
Wilson, Major D. C., D.S.O., from Staff, War Office, to Att. 12th Bde. 1/4/22.
Wisely, Capt. G. L. K., M.C., from Int. Corps, Rhine, to 63rd Batty. 5/4/22.

Postings.—R.G.A.

Barford, Lieut. B. C., from 4th Batty., to "W" Coast Batty. 11/4/22.
Beattie, Capt. A. J., M.B.E., M.C., from Att. Irish Comd., to 50th Coy., Sierra Leone. 22/3/22.
Bell, Capt. L. G. R. F. H., M.C., from D.A.Q.M.G., Iraq, to Adjt., R.G.A., Ceylon. 24/3/22.
Bennet, Capt. L. W., from 40th Batty., to "V" Coast Batty. 8/4/22.
Bond, Maj. (Bt. Lt.-Col.) E. L., D.S.O., from 25th Batty., to 1st Res. Bde. 21/3/22.
Brown, 2nd Lieut. E. G., from 35th Batty., to "Y" Coast Batty. 8/4/22.
Bunbury, Major R S., D.S.O., from 40th Batty., to "V" Coast Batty. 8/4/22.
Campbell, Lt.-Col. K. G., D.S.O., from 8th Bde., to Att. 1st Res. Bde. 13/4/22.
Capell, Lieut. B. A., from 14th Batty., to Headquarters, 1st Bde. 27/3/22.

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Postings R.G.A.—(Continued).

Chuter, Capt. E., M.C., from Adjt. & I.G., Rangoon, to R.G.A. Isle-of-Wight. 1/4/22.
Collier, Lieut. R. D. T., from Att. 10th Bde., to "V" Coast Batty. 8/4/22.
Crane, Lieut. H. S., from 95th Coy., to Tees & Tyne. 4/4/22.
Donnelly, Major G. H., M.C., from Staff Capt., War Office, to Unposted. 1/4/22.
Dowman, Lieut. J. P. G., from 1st Pack Batty., to 10th Batty. 10/4/22.
Fendall, 2nd Lieut. W. P., from 9th Bde., to "Y" Coast Batty. 13/4/22.
Galloway, Major L., D.S.O., from 8th Bde., to Att. 1st Res. Bde. 13/4/22.
Garwood, Major (Bt. Lt.-Col.) H. P., D.S.O., from G.S. Course, to Comd. Survey Coy. R.A. 13/4/22.
Gibbs, Lieut. G. H., from Advanced Class, to "J" Coast Batty. 28/3/22.
Goff, Major T. C., D.S.O., from 34th Batty., to S. Irish Coast Defences, Queenstown. 27/3/22.
Gyde, 2nd Lt. W. J., from 6th Batty., to "V" Coast Batty. 8/4/22.
Harvey, Lt.-Col. W. K., from S. Irish Coast Defences, to R.G.A., Sierra Leone. 21/3/22.
Hill, Lt.-Col. R. R., D.S.O., from 10th Bde., to S. Irish Coast Defences. 21/3/22.
Hunt, Lieut. C., from 25th Batty., to Att. 2nd Pack Arty. Bde. 6/4/22.
Jenkins, Capt. W. M., from 35th Batty., to "Y" Coast Batty. 8/4/22.
Jones, Lieut. C. W. F., from 8th Bde., to 1st Pack Arty. Batty. 10/4/22.
Kirby, Lieut. A., from S. of G., Larkhill, to 50th Coy., Sierra Leone. 22/3/22.
Lambooy, Lieut. A. P., from 32nd Batty., to "Y" Coast Batty. 8/4/22.
Le Gros, Lieut. F. G., from 2nd Pack Arty. Batty., to Att. 1st A.A. Bde., R.F.A. 5/4/22.
Luker-Brown, Lieut. W. G. A., from S. Irish Coast Defences, to Att. 1st A.A. Bde., R.F.A. 24/3/22.
MacDonald, Lieut. A. G., from 4th Batty., to "W" Coast Batty. 11/4/22.
Mascall, Major M. E., D.S.O., O.B.E., from II. Res. Bde., to 18th Pack Arty. Bde., R.G.A. 20/3/22.
Michaelis, Capt. C. D. A., from R.A. Survey Coy., Larkhill, to S. Irish Coast Defences. 29/3/22.
Moorhouse, Lieut. S. J. H., from Att. R.A.O.C., Rhine, to Att. H.Q. & D.E., R.G.A., Dover. 3/4/22.
Murley, Lieut. W. A., M.C., from No. 4 Depôt, R.G.A., to 50th Coy., Sierra Leone. 22/3/22.
Niven, Lt.-Col. O. C., D.S.O., from 7th Bde., to 3rd Bde., Malta. 21/3/22.
Peters, Capt. R. B., from Staff, to S. Irish Coast Defences. 15/4/22.
Richards, Lieut. M. J., O.B.E., from Staff, War Office, to R.G.A., Dover. 1/4/22.
Roberts, Capt. H. W., O.B.E., from Staff Capt., 25th Inf. Bde., Ireland, to H.Q. & D.E., Portsmouth. 24/3/22.
Rothwell, Major R. S., D.S.O., from Garr. Adjt., Cork, to Att. 2nd Pack Arty. Bde. 24/3/22.
Skelton, Lieut. R. E., from Advanced Class, to "L" Coast Batty. 28/3/22.
Spedding, 2nd Lieut. J E., from 9th Bde., to Att. 5th Pack Arty. Batty. 10/4/22.
Smith, 2nd Lt. I. K., from Cipher Officer, Irish Comd., to 1st Bde., R.G.A. 24/3/22.
Suddick, Lieut. R. H., from Att. Irish Comd., to H.Q. & D.E., Tees & Tyne. 28/3/22.
Thomas, Capt. G. P., O.B.E., from 32nd Batty., to "X" Coast Batty. 8/4/22.
Watson, 2nd Lt. C. B. G., from Att. 8th Bde., to "X" Coast Batty. 8/4/22.
Watson, Major R. H. M., D.S.O., from 36th Batty., to "Y" Coast Batty. 8/4/22.
Wilson, Lieut. G. H., from 32nd Batty., to "X" Coast Batty. 8/4/22.
Wrisberg, Lieut. F. G., from Advanced Class, to Portsmouth. 28/3/22.

Staff Appointments.

Royal Artillery.

Montgomery, Maj.-Genl. Sir A. A., K.C.M.G., C.B., Divisional Commander, Territorial Army. 3/3/22.
Thwaites, Maj.-Genl. Sir W., K.C.M.G., C.B., Appointed D.M.O. & Intell. at War Office. 1/4/22.
Weber, Col. W. H. F., C.M.G., D.S.O., G.S.O.1., Ulster District. 8/3/22.
Wilson, Col. F. A., C.M.G., D.S.O., C.R.A., 44th Home Counties Division, Territorial Army. 25/3/22.

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Royal Horse and Royal Field Artillery.

Adam, Major R. F., D.S.O., O.B.E., G.S.O.3. S.D.8. War Office. 1/4/22.
Bayley, Lieut. C. D., M.C., Adjt., 101st (Glasgow) Yeo. Bde. R.F.A., T.A., and Temp. Capt. Territorial Army. 20/3/22.
Collins, Major H. G., M.C., Asst. Inspr., Inspn. Dept., Woolwich. 1/4/22.
Evelegh, Capt. E. D., M.C., A.D.C., to Governor of Bengal. 9/3/22.
Ferguson, Lieut. R., Attd. R.A.O.C., Iraq. 9/1/22.
Green, Lieut. A. P., D.A.P.M., Ulster District. 2/3/22.
Gubbins, Capt. C. Mc V., M.C., Bde. Maj. R.A., 5th Divn. (Temp.) 28/2/22.
Hackett, Lieut. T. W. D., M.C., Seconded for Egyptian Army. 17/2/22.
Landon, Capt. G. de L., M.C., Att. Officer D. of A. (A.2). 1/4/22.
Mackey, Lieut. W. G., M.C., Temp. Capt., for service with Somaliland Camel Corps. 19/3/22.
Martin, Major H. G., D.S.O., O.B.E., D.A.A.G., A.G'c Branch, A.H.G., India. 20/1/22.
Selwyn, Capt. J., A.-D.-C. to Governor of Bengal. 9/3/22.

Royal Garrison Artillery.

Allan, Lieut. A. J. W., Att. Officer. M.I.1.b., War Office. 10/4/22.
Brown, Lieut. P. W. F., Intelligence Officer. 28/2/22.
Byrne, Bt. Lt.-Col. J. D., D.S.O., Bde. Maj., 1st Air Defence Brigade. 1/4/22.
Graham, Major R. C. D., D.A.A.G., Bombay District. 1/4/22.
Holden, Capt. W. C., D.S.O., M.C., Capt. I.G., Arty. School, Larkhill. 25/2/22.
Hurford, Capt. D. L., M.C., Asst. Proof & Experimental Officer, Research Dept., Woolwich. 27/3/22.

Promotions (Regimental).

Broadhurst, Capt. (D.O.) O., to be Major (D.O.) and to remain seconded. 19/2/22.
Everton, Capt. (D.O.) W. T. A., M.C., To be Major (D.O.) and to remain seconded. 19/2/22.
Lyle, Capt. (D.O.) J., to be Major (D.O.) 2/4/22.
Rowe, 2nd Lieut. S. E., to be Lieut. R.G.A., 22/12/21, with seniority 18/11/20.
Scarlett, Bt. Lt.-Col. J. A., D.S.O., to be Lt.-Col. R.F.A. 20/3/22.
Wales, Lieut. (D.O.) A. H., M.C., to be Capt. (D.O.) and to remain seconded. 2/4/22.
Webb, Lieut. (D.O.) C. G. F., M.C., to be Capt. (D.O.) 2/4/22.

Promotions (Non-regimental).

Suther, Lt.-Col. P., C.M.G., D.S.O., R.G.A., to be Colonel 28/3/22, with seniority 1/1/21.

To Temporary Half Pay.

Altree, Lieut. E., M.C., R.F.A. 3/4/22.
Brierley, Lt.-Col. G. T., C.M.G., D.S.O., R.G.A., on ceasing to be employed with R.A.F. 1/4/22.
Connell, Lieut. E. S., M.C., R.G.A., on account of ill health. 12/4/22.
Cooper, Lieut. M. H., R.F.A., on account of ill health, on ceasing to be employed. 1/4/22.
Dods, Lieut. I. W. E., R.F.A., while employed under Colonial Office. 25/1/22.
Deverell, Lieut. J. L., R.F.A., on account of ill health. 25/2/22.
Jordan, Capt. A. E., M.C., R.G.A., on account of ill health. 17/3/22.
O'Connor, Lieut. C. C., M.C., R.G.A., on account of ill health. 12/4/22.
Pusey, Lieut. F., R.F.A., on account of ill health. 14/4/22.
Redman, Lieut. F. V. L., R.G.A., on account of ill health. 1/4/22.
Shewell, Lt.-Col. E. F., C.M.G., D.S.O., R.F.A., on completion of 4 years Lt.-Col. 20/3/22.
Walters, Lt.-Col. H. de L., C.M.G., D.S.O., R.G.A., on completion of 4 years Lt.-Col. 31/3/22.

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Retirements on Retired Pay.

Allcard, Lt.-Col. H., D.S.O., R.F.A., from half-pay. 13/3/22.
Allen Major (D.O.) R. H. 2/4/22.
Biggs-Davison, Major J. N., R.G.A. 22/3/22.
Disney, Major J. W. K., R.G.A., from half-pay, on account of ill health. 17/12/21.
Hall, Major E. C., R.F.A. 18/3/22.
Humphrey, Lieut. F. E., R.F.A. 8/4/22.
Lawson, Major C. G., R.F.A. 1/4/22.
Patman, Lieut. B. P., R.G.A., from half-pay, on account of ill health. 21/3/22.
Purton, Lieut. G. A., M.C., R.F.A., with rank of Capt. 28/3/22.
Sprinks, Capt. W. J., R.G.A. 3/4/22.
Walker, Lieut. F. Mc F., R.G.A. 12/4/22.
Warner, Capt. H. H. M., R.G.A., on account of ill health. 8/4/22.
Westell, Capt. (D.O.) C. E., from half-pay, on account of ill health. 18/3/22.

Retirements with a Gratuity.

Delaney, Lieut. M., R.G.A., from half-pay. 16/11/21.
Hinton, Lieut. N. R., R.F.A., from half-pay. 15/12/21.

Resignations.

Bernard, 2nd Lieut. B. F., R.F.A. 29/3/22.
Critchley, Lieut. G. H., M.C., R.F.A. 29/3/22.
Hardie, Lieut. A. S., R.F.A. 20/3/22.
Saltwell, Lieut. E. J., M.C., R.F.A. (H.P.) and granted rank of Capt. 8/4/22.
Voelcker, Lieut. J. F., R.G.A. 1/3/22.

Loss of Seniority.

Thompson, Lieut. W. C., R.G.A. (To take rank and precedence in Army as if promotion to Lieut. bore date 26/5/1918).

Deaths.

Burnside, Capt. E. L., R.F.A., died. 14/3/22.
Cadie, Lieut. R., M.C., R.F.A., died at Aldershot. 31/3/22.
Evans, Major E. B., (retired), died at Cantley. 21/3/22.
Land, Capt. (Qr.-Mr.) I., (retired), died at Portsmouth. 22/3/22.
Malet, Lieut. H. R., M.C., R.G.A., Accidentally shot. 10/3/22.
Phillips, Lieut. W. W., late R.F.A., died. 22/1/22.
Standbridge, Col. E. B. (retired), died. 3/3/22.
Sugden, Capt. P. L., M.C., R.G.A., (R. of O.), died. 27/3/22.
Withers, Lieut. A., R.F.A., died at Singapore. 4/4/22.

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PART II.

NOTES ON FOREIGN JOURNALS

Belgium.

Bulletin belge des Sciences Militaires.—May, 1922.

Operations of the Belgian Army. (Continued).

Machinery in a battle. Col. Fastrez.

Belgian and French Aviation on the Western Front V. Comdt. Desmet.

Wireless Telephony. Cap. Comdt. Rootsaert.

France.

Revue Militaire Francaise.—May, 1922.

Gén. Buat. Hindenburg and Ludendorff's campaigns on the Western Front V.

Gén. Cordonnier. The right of the French 4th Army on Aug. 22, 1914.

Comt. Prioux Cavalry in defence.

Lt.-Col. Gémeau. Marshal Haig—a great allied commander.

Revue Militaire Générale.—April, 1922.

Gén. d'Urbal. The army we require.—

General d'Urbal lays it down as an axiom that the French army must be constructed, not for war in general, but with the object of being prepared for a definite war, considered as being possible.

France, he says, never will go to war, except if forced to in defence of her honour, or to guarantee the respect for treaties. He is not so sure of Germany's attitude and says that supposing an outrage on the French flag were to occur, for which the German government could not or would not give satisfaction, or if Germany were to refuse to meet her obligations, then war must again break out.

He then goes into the numbers required and how they should be used to prevent the Germans from effecting their concentrations of troops, near enough to menace another invasion of French Territory.

He suggests a first line of	300,000 men.
The cadres of a second line of mainly fighting troops of	260,000
The cadres of the 3rd échelon and permanent staff of lines of communication	50,000
Total	610,000

He wants to be in a position to launch offensives on Berlin by Magdebourg and Torgau and on Munich by Ulm and Ingolstadt.

On mobilization he wants a northern group of Armies 800,000 strong, and a southern group of 600,000 and a reserve army 200,000 to keep touch with the two groups.

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Assuming the 1st échelon to be 300,000 who should always be up to strength, the second échelon must thus produce 1,300,000 men.

Counting one man of the permanent cadre of the 2nd échelon to four reservists the second échelon must in peace have 260,000 men.

Lucius. The recasting of regulations and our war doctrine IX. (same period as VIII.)

Gén. Magnin. Our colonies to the rescue.

Germany is a going concern again and intends to be revenged on France, who may have to act alone. Though the danger increases yet economic conditions demand military reductions.—The colonies therefore must be called on.—The political horizon of the world in spite of the Washington conference is banked with storm clouds.

Revue d'Artillerie.—April, 1922.

I. Some notes on peace manœuvres. Gen. Broussard.
II. Artillery material, and its employment. (i) Col. Cambuzat.
III. On mountain artillery (i). Capt. Mortureux.
IV. Special method of working out topographical data in connection with Artillery Fire. (i). Maj. Benoist.
VI. Employment of Artillery in Germany. (Notes on the Sept. 1921 handbook).
VII. Liaison between Infantry and Artillery (translation of Capt. A. G. Wildey's *Practice Camp Reflections, 1921.*

Germany.

Militar-Wochenblatt.—11th March, 1922.

Germany's defencelessness.

To strengthen the impression of a previous article on this subject, a picture, extracted from the 'Scientific American', is given which shows graphically by means of guns of different sizes the number of guns possessed by each of the Great Powers.

The Military and Political World Situation.

Deals mainly with the law of one-year service in France; with Englands' gradual recognition of the failings of the treaty of Versailles of her difficulties in Egypt and in India and of the loss due to long-range guns, submarines and aircraft, of her splendid isolation.

Days of remembrance.

Suggests that the ex-officers league should fix dates near the turning points of great battles of the European War to be kept as days of proud remembrance.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

British Battles—Tourcoing. By Hiliare Belloc. London (Stephen Swift). n.d.

Indian Frontier Warfare. By Bt. Major G. J. Younghusband. London, (Kegan, Paul) 1898.

The Campaign in Tirah, 1897-1898. By Col. H. D. Hutchinson. London (Macmillan) 1898.

Hannibal. Soldier, Statesman, Patriot. By W. O'Connor Morris. New York (Putnam) 1896.

The Relief of Chitral. By Captains G. J. & F. E. Younghusband. London (Macmillan) 1897.

The Land of Uz. By G. Wyman Bury. London (Macmillan) 1911.

Arabia Infelix, or The Turks in Yamen. By G. Wyman Bury. London (Macmillan) 1915.

Official History of the Russo-Japanese War. Part IV.—Liao-Yang. London (S.O.) 1909.

L'Esprit de la Guerre Moderne—La Manœuvre de Vilna. By Genl. H. Bonnal. Paris (Chapelot) 1905.

Also a quantity of Dictionaries, Grammars, etc., for the use of Officers studying for Examinations in Foreign Languages.

Above were presented by Major-Genl. Sir W. R. Ironside, K.C.B., C.M.G., D.S.O.

A Familiar History of the British Army from The Restoration in 1660 to the present time. (1871). By J. H. Stocqueler. London (Stanford) 1871.

Napoleon at Bay 1814. By F. Loraine Petre. London (John Lane) 1914.

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PART II.

NOTES ON FOREIGN JOURNALS

Belgium.

Bulletin belge des Sciences Militaires.—June, 1922.

Operations of the Belgian Army. (Continued).

The operations on the Italian Front. (3 maps.) Maj. van Overstraeten.

The tactics of "attrition". Col. Fastrez.

Review of recent Italian publications on ballistics. IV. L. Godeaux.

German combined training I.

France.

Revue Militaire Francaise.—June, 1922.

Gén. Buat. Hindenburg and Ludendorff's campaigns on the Eastern Front. (Conclusion).

Comt. Prioux. Cavalry in defence.

Revue Militaire Générale.—May, 1922.

Gén. d'Urbal. Present military possibilities.

Lucius. The recasting of regulations and our war doctrine X. Period Spring 1918.

Gén. Magnin. Our colonies to the rescue. (Conclusion).

Revue d'Artillerie.—May, 1922.

Organisation of practice series indoors. Lt.-Col. Doucet.

Some achievements of artillery. St. Mihiel 1914. Gén. Rouquerol.

Artillery material and its employment. (Concl.) Col. Cambuzat).

On Mountain Artillery. (Continued). Capt. Mortureux.

Instructions in the use of the 75. Maj. Richomme.

Employment of Artillery in Germany. (Notes on the 1921 handbook—continued.)

Switzerland.

Revue Militaire Suisse.—May, 1922.

Offensive action by a division. Maj. Bégou.

New regulations and methods in battle. Maj. de Valliere.

Germany.

Militär Wochenblatt.—April, 1st, 1922.

Historical reflections on Bismarck's day.—Gen. von Altrock.

Goes back to the good old days of Bismarck, Prussia, and the Hohenzollerns and thinks their methods must be studied as a framework for the future of Germany. Bismarck and the old Kaiser had

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worked together on the old motto "Not freedom but power is the prime need of Prussia."

The situation in the far East.

Describes recent minor operations between Bolsheviks and White Russians in the Vladivostock region.

The situation in Autumn 1918.

A pamphlet war is in progress as to whether the German army was fit or not to fight in November 1918.

Militär Wochenblatt.—15th April, 1922.

General von Falkenhayn. By Gen. von Kuhl.

A sympathetic account of the actions in the Great War of one of the outstanding leaders on the German side. Falkenhayn took charge on the departure of Moltke just when the Schlieffen plan, on which Germany had built her hopes, had failed; and he remained at his high post till August 1916. He was the protagonist of the wearing down process, of limited objectives of the conservation of Germany's resources. The war could only be won if decisive success in the east would release sufficient divisions to secure victory in the West. Yet he always declined to take the necessary risk, not from caution, but for fear of diminishing the staying power of Germany which he believed to be his trump card. His attack on Verdun was a failure but the Allies have admitted how near it was to success and how correct it was in conception. He rendered brilliant service in Rumania and he leaves a name that will be highly honoured for, in spite of various failures, he was a great leader in a great period.

How Russia lighted the torch for the World War.

Reference is made to a recent article by General Dobroriski who was Chief of the Mobilisation Section at Russian General Headquarters in 1914. The Russian ministers and general staff realized that a general mobilization would mean a world war. The Czar ordered first a partial mobilization, then a general mobilization—then, on representations from Germany, a partial mobilization, and finally under strong pressure from Sasonov and Yanushevitch, a general mobilization. The last named order went out on the 30th July, 18 and 42 hours before the corresponding orders issued by Austria and Germany respectively.

The Emperor Charles.

It was greatly hoped that when the Emperor Charles succeeded his uncle, he would energetically press the war, but he unfortunately succumbed to the influence of his wife who favoured the French. He was therefore never a great asset to the Central Powers.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

The Encyclopædia Britannica, Vol. 31.

Esher (Reginald, Viscount). The Tragedy of Lord Kitchener. London (Murray) 1921.

French (F.M. Viscount) 1914. London (Constable) 1919.

Ward (Col. John). With the "Die-Hards" in Siberia. London (Cassell) 1920.

Nevinson (Henry W.) The Dardanelles Campaign. London (Nisbet) 1918.

Aston (Major-Genl. Sir George). Memories of a Marine. London (Murray) 1919.

Graham (Stephen). The Challenge of the Dead. London (Cassell) 1921.

Durand (Sir Mortimer). The Life of F.M. Sir George White, VC., etc. 2 Vols. Edinburgh (Blackwood) 1915.

Monash (Lieut.-Genl. Sir John). The Australian Victories in France in 1918. London (Hutchinson).

Bellairs (Commdr. Carlyon). The Battle of Jutland. London (Hodder & Stoughton).

Scheer (Admiral). Germany's High Sea Fleet in the World War. London (Cassell) 1920.

Gibson (R. H.) Three Years of Naval Warfare. London (Heinemann) 1918.

Hurd (Archibald). The British Fleet in the Great War. London (Constable) 1918.

Fraser-Tytler (Major Neil). With Lancashire Lads and Field Guns in France, 1915-1918. Manchester (Heywood) 1922.

(Presented by the Author).

Catalogue of the War Office Library, Part III (Subject Index) Tenth Annual Supplement (Jan. to Dec., 1921). London (S.O.) 1922.

Grant (Major D. F.) The History of "A" Battery, 84th Brigade, R.F.A., 1914-1919. London (Marshall Bros.) 1922.

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PART II.

NOTES ON FOREIGN JOURNALS

Belgium.

Bulletin belge des Sciences Militaires.—July, 1922.

Operations of the Belgian Army. (Contd.)
The rôle of the Division in war. Col. P. Nuyten.
Tactical use of machine guns. Maj. A. Bogaerts.
The problem of 'liaison' (I). Cap. Com. Baron Guillaume.
Review of recent Italian publications on ballistics (V). L. Godeaux.
German Combined training (II).

France.

Revue Militaire Francaise.—July, 1922.

Gén. Gamelin. Napoleon's strategy. (I.)
Lt.-Col. Lepetit. The genesis of the Macedonian Offensive.

The writer shows the evolution of ideas, and influences political and other, in consequence of which it was undertaken. He commences from the end of 1917 when Gen. Guillaumat succeeded Sarrail in the command of the allied armies of the East.

Franchet D'Esperey succeeded him.

Gen. Guillamat was recalled to France, after the Aisne front was broken on May 27, 1918, and arrived at Paris on June 12.

Gen. Guillaumat's connection with the Eastern Armies by no means ceased with his return to France, as no important decision was taken without his being consulted.

Gen. Hellot. The defence of France from Vauban's time onwards.
Comdt. Maurice Fournier. The Red Army of the Bolsheviks (I).

Revue Militaire Générale.—June, 1922.

Gén. Rostovtseff. The fatal military errors of Tsarist Russia.
Lt.-Col. Alléhaut. Support of infantry by the gun.

Revue d'Artillerie.—June, 1922.

Co-operation between Artillery and Infantry. Gén. Broussard.
Liaison, and liaison officers. Maj. Brun.
Silent Registration of guns. Gén. Challeat.
On Mountain Artillery (continued). Capt. Mortureux.
Employment of Artillery in Germany. (Notes on the 1921 handbook—continued.)

Switzerland.

Revue Militaire Suisse.—June, 1922.

The conduct of the war up to the battle of the Marne. Col. Poudret.

Offensive action by a division. (Concl.) Maj. Bégou.

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Germany.

Militär Wochenblatt.—22nd April, 1922.

The Great War 1914—1918.

General Schwarte who so industriously edited those very large volumes "The military lessons of the Great War" and "Technique in the Great War" has now embarked on a still more ambitious work in ten volumes under the above title. Only the first and the eighth have yet appeared. They are highly praised, the contributors being officers who had personal experience in high office of the events and of the subjects they deal with.

Neutral contributions to the Study of the Battle of the Marne.

The first of a series of volumes on the Battle of the Marne. "The battle of the Ourcq" by a Swiss officer of the General Staff Dr. Bircher has just appeared and is highly commended by L.Col. Müller-Loebnitz who reviews it here.

The Lithuanian Army.

A résumé of an article by Commandant d'Etchegoyn in La France Militaire. The Commandant puts the number of Lithuanians who served in the Russian Army at 742,000 of whom 200,000 were killed or wounded. The army is now on a good footing. Conscription has been introduced. The peace strength is 30,000 and in war 200,000 brave well-disciplined well-led troops could be placed in the field.

The German writer appears to think this estimate exaggerated and he is probably correct in his opinion.

German disarmament.

A table showing the point reached in German disarmament. If the table is correct the world has never seen such thorough work and the commission charged with this duty may be heartily congratulated for hardly a weapon or a round is said to remain.

29th April, 22.

The crisis in the Italian Army in October 1917 by Colonel von Pohl.

A continuation of the mutual recriminations on this subject, carried on in this number by the Austrians. The statement that the Austrians were ordered to attack the Germans should they cross their front in an attempt to cut off the Italian 3rd Army is categorically denied.

The Red Army.

Changes of organisation are in progress. The present strength is 1,600,000 including the navy and police. Numerous officers courses are being held lasting 1, 2 or 3 years for all ranks even Brigade Commanders.

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Morocco.

Mainly quotations from an article in "France Militaire" suggesting a Franco Spanish entente in the Mediterranean and pointing out that a rapprochement with France would be more valuable to Spain than one with England.

The battle of the Marne.

Dr. Bircher a Swiss officer lecturing in Berlin asserted that the Germans had actually won their battle when headquarters 2nd Army had an attack of nerves and decided to retreat.

6th May, 22.

The military and political situation in Great Britain by L.Gen. Balck.

A long article and worth reading. England is regarded as being in a much worse position than after the Napoleonic wars both militarily and economically—the main reason given being that Lloyd George has departed from the tradition of the maintenance of the Balance of Power. He had been accustomed to get his own way with France but once the German Army had disappeared the French could snap their fingers at him.

Militär Wochenblatt.—13th May, 22.

Review of the military and political situation in the Pacific. By Professor Hanshofer.

The Washington Treaty is already showing good results in the amicable relations existing between Powers in the Pacific. The civil war in China and the fighting between Bolsheviks and Japanese are the the only blots on the picture.

Asiago or Verdun by General von Cramon.

A long discussion as to whether the correct strategy of the Central Powers should have been an attack in Italy or at Verdun. Conrad was the advocate of the former, Falkenhayn of the latter. Falkenhayn did not believe any action however successful in Italy could have a decisive effect on the general operations. There was a good deal of friction between the two High Commands showing very clearly that Germany had had no intention of making war; for if she had intended to wage war she would most certainly have settled the question of command beforehand.

Council of War in Warsaw and Storm-signals.

Warsaw is in ferment over the defence of its frontiers.

War is expected with the Bolsheviks, and Germany is believed to be bound to join in under secret clauses of the Russo-Germany treaty. The excitement in the Polish capital synchronizes with a particularly militarist outburst in the French papers.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Hunting (William). The Art of Horse-Shoeing. London (Halliere, Tindall & Cox) 1922. 10/6.

Hamilton (Genl. Sir Ian). The Soul and Body of an Army. London (Arnold) 1921.

Bywater (Hector C.) Sea-Power in the Pacific. A Study of the American-Japanese Naval Problem. London (Constable) 1921.

Minutes of Procedings of the Institution of Civil Engineers, Vol. 212, 1920-21. Part II.

The Statesmens Year-Book, 1922.

The Encyclopædia Britannica, Volume 33.

Carncross (Lieut.-Genl. Sir J. H.) Course of Artillery and Fortification at the Royal Military Academy. 2 Vols. of Plates only. MS. Fol. Woolwich, (Presented by Major G. T. Stickland, O.B.E., R.F.A.) 1791.

Boraston (Lieut.-Col. J. H.) Sir Douglas Haig's Despatches. (Dec., 1915—April, 1919.) London (Dent) 1920.

A quantity of Books suitable for Staff College Examinations. (Presented by Major C. R. Bates, D.S.O., M.C., late R.A.)

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—Aug. 1922.

Operations of the Belgian Army. (Contd.)

Fighting exhausts the army, the army consumes the nation. Col. Fastrez.

The problem of liaison (II). Cap. Com. Baron Guillaume.

German Combined Training III.

France.

Revue d'Artillerie.—July, 1922.

Our heavy field artillery during the recent war. Gén. Fain.

Notes on the organisation of artillery of higher units and the general reserve of artillery. Maj. Z.

Effect of wind on shooting. Maj. Menjaud.

Reorganisation of the Italian artillery.

Employment of artillery in Germany.

(Notes on 1921 handbook.—Contd.)

Miscellaneous. Germany. Official abbreviations of nomenclature of troops.

W.K. II. Command of 2nd district (*Wehrkreis-Kommando II.*)
1.D. 1st Infantry Division.
Art. F.I. Command of Artillery of 1st Divn.
1/I. R.1. 1st Co. 1st Regt. Infantry.
I/A. R.3. 1st Group of 3rd Regt. of Arty.
1/A. R.3. 1st battery of 3rd Regt. of Arty.
11 (r)/A. R.3. 11th horse battery 3rd Regt. of Arty.
A/A. R.3. Training battery 3rd Regt. of Arty.

Germany.

Militär-Wochenblatt. No. 47. 18th May, 1922. (H.R—R.)

Recollections of Field Marshal Conrad von Hotzendorf.

A review by von Kuhl on the first volume 1906—1909. A very interesting article. When Conrad took up the reins as Chief of General Staff, Austrian Army, the outlook of the Dual Monarchy was gloomy. Germans far outnumbered and generally disliked. Hungary wanted independence; Italy the Adriatic; Rumania parts of Transylvania; Russia a road through the Balkans to Constantinople; Serbia a great Slav kingdom and so on.

Conrad was always anxious to attack anyone of his probable

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opponents whenever a favourable opportunity arose, and was very sad at not being allowed to profit by Russia's weakness after her war with Japan.

Correspondence with von Moltke initiated in 1909 throws much light on the arrangements for Austro-German co-operation in the event of a great war. The general scheme agreed to was in the main that which eventually materialised. Conrad, however, wanted to hasten the transfer of German reinforcements from the west, and under pressure from him, Moltke agreed that the decisive battle might occur in the 3rd or 4th week (according to whether the French acted on the offensive or the defensive) and that transfer of considerable forces from west to east should therefore be completed between the 30th and 40th days. It is just possible, von Kuhl thinks that this promise had considerable weight when the decision to despatch two corps to the east was reached towards the end of Aug. 1914.

Conrad rather implies that the failure of the Austrian offensive was due to lack of German support. Von Kuhl thinks it was due to bad planning. Galicia was very badly shaped for the launching an offensive from its borders, but it was admirably situated for use as a flank position against Russian forces advancing by Posen on Berlin. Further the employment of half the available Austrian forces against Servia rendered the prospects of success against Russia almost hopeless.

No. 48. May, 27, 1922.

Captive balloons in the German attacks of 1918. By Capt. Mischer.

Considerable claims are made by the writer which may require verification. He says that in spite of bad weather the first and only reports received by the General Staff on March 21 were sent by balloons and that many counter-attacks were beaten off owing to the early notice they gave of them. The balloon sections had been thoroughly trained for moving warfare and rendered invaluable service during the advance.

The Army of Wrangel.

The army is now quartered—20,000 in Servia, 27,000 in Bulgaria. Wrangel is training it carefully and intends to make it the kernel of the future Russian army.

No. 49. June 3, 1922.

Captive balloons in the German attacks of 1918. II. Capt. Mischer.

The translator can vouch for the Efficiency of the German balloon service during the period in question. Capt. Mischer's two articles are therefore worth noting and can be summarised thus :—

(1) Balloon sections must be very carefully trained and organised beforehand for a war of movement if they have been employed in position warfare.

(2) They should be provided with horsed transport to enable them to move across country, but first line transport can be mechanical and move on roads.

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(3) Sufficient gas for at least two fillings must accompany the section.
(4) Every form of communication should be practised. Pigeon post had often to be resorted to.
(5) A balloon will generally have a brigade or battery of artillery attached to it—but its duty in moving warfare is even more to help the infantry than the artillery.
(6) Batteries to obtain observations, and obviate communication difficulties will often group themselves round a balloon.

Switzerland.

Revue Militaire Suisse:—July, 1922.

The future of our army. Col. Lecomte.
The Infantry Gun. Jean Fleurier.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Boraston (Lieut.-Col. J. H.) Sir Douglas Haig's Despatches. (Decr. 1915—April 1919). London (Dent) 1920.

Cornish (Vaughan). A Geography of Imperial Defence. London (Sifton, Praed) 1922.

Archer (William). India and the Future. London (Hutchinson) 1917.

Corbett (Sir Julian S.) History of the Great War—Naval Operations, Vol. II. London (Longmans, Green) 1921.

Price (Julius M.) Six Months on the Italian Front. From the Stelvis to the Adriatic, 1915-16. London (Chapman & Hall) 1917.

Haldane (Lieut.-Genl. Sir Aylmer). A Brigade of the Old Army, 1914. London (Arnold) 1920.

Fisher (Admiral of the Fleet Lord). Memories. London (Hodder & Stoughton) 1919.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—Sept. 1922.

Operations of the Belgian Army. (Continued).

Fighting exhausts the army, the army consumes the nation (II.) Col. Fastrez.

Lessons of the war regarding counter-attack. Col. Nuyten.

The problem of liaison (III.) Cap. Com. Baron Guillaume.

German Combined Training (IV.)

France.

Sept. 1922.

Général Gamelin. Napoleon's strategy (III.)

Lt.-Col. Oehmichen. The French High Command in 1916 (I.)

Col. Viotte. On Surprise.

Col. Treguier. Artillery of direct support.

Revue Militaire Générale.—July 1922.

Général Lavigne-Delville. Cavalry and service for 18 months.

Lucius. The recasting of regulations and our war doctrine (XII.) (Final period of the war from 18th July, 1918, up to the armistice).

Revue d'Artillerie.—Aug. 1922.

The 155 G.P.F. in the field. Capt. Augustin.

On Mountain Artillery. (Contd.) Capt. Mortureux.

Employment of Artillery in Germany.—Notes on 1921 handbook. (Concl.)

In these notes which have been published in the *Revue d'Artillerie* monthly since last April, it will be noted that the methods of employment of artillery, generally speaking, remain as they were at the end of the war. Regarding the tactical units in actual battle, one finds them as in 1918, with certain modifications.

Infantry batteries are now recognised as permanent. (Batteries that split up to provide the gun of accompaniment.)

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The Artillery of close combat.

Part of this will be allotted to infantry commanders to support its advance in greater measure than the infantry batteries. This will remain grouped, and in touch with the divisional artillery, and can be placed under its order for concentrations.

The remainder of the *close combat artillery*, under the C.R.A. of a division, is split up into groups and sub-groups corresponding to the infantry sectors.

Germany.

Militär Wochenblatt. (H. R—R.)

No. 50. 10th June, 1922.

The Theatre of Politics by L.Gen. v. Altrock.

A ranting article repeating well-worn statements as to Germany's innocence.

The Field Artillery of the United States.

La Paix.

Criticisms on M. Tardieu's book.

No. 51. 17th June, 1922.

The Politico-Military situation in Poland and the Baltic States. Jan. to March, 1922.

Not much change is indicated.

The War in the North Sea. Sept.—Nov., 1914.

A review of the official account by Admiral Dick. Is interesting in its account of the friction in the Admiralty and between the Admiralty and the Cabinet with regard to the policy of keeping the fleet intact for use as a bargaining asset at the end of the war.

Psychology—The General.

A review of a book of this title by Kurt Hesse dealing with the effect of mass-psychology in war. Gumbinnen was lost by the Germans because they looked upon themselves as a small handful of men who were bound to be destroyed by the Russian colossus, while their comrades were marching merrily to assured victory in France. The effect of mass-psychology both on soldiers and on the people is treated throughout all the various stages of the war.

Franco-Polish incitements to War.

No. 52. 24th June, 1922.

The States of South-Eastern Europe.

The Little Entente (Roumania, Poland, Czecho-Slovakia, Jugo-

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Slavia, still dominates the situation in S.E. Europe. It has three main objects in view :—

1. The severance from Germany of her former allies—Bulgaria and Hungary. (Austria has already to some extent been drawn into the circle).

2. Economic confederation of the Danube States, but not under the tutelage of the Western Powers.

3. A position equal to that of the Great Powers at conferences where questions of general European interest are discussed.

M. Benes has already made great progress in these directions. The Little Entente can dispose of armies amounting to about 912,000 men.

A review of technical matters. By Capt. Polster.

The new American 75 m.m. model with a split trail is said to have a range of 14,500 yds. The new 105 m.m. field howitzer goes on the same carriage.

The day of standing armies.

An extract from Oswald Spengler's book "The Downfall of Twilight-land."

Germany's expenditure in arms and ammunition in the World War.

5 months after the beginning of the war, the daily output of rifles was 1,200, later it rose to over 8,000. In the autumn of 1917, the monthly output of machine-guns was 13,000, that of field guns 3,000.

No. 1. (New series). 1st July, 1922.

Politico-Military Matters in Russia. Feb.—April, 1922.

In spite of the fact that the population has fallen from 168 to 130 millions, the army is still up to pre-war strength.

The gold reserve has dropped from 750 to 30 millions. Church measures are now being impounded.

The general situation of the country is as bad as ever.

The Extradition list.

Considers that ludicrous charges have been made against the 890 German prisoners about to be tried at Leipzig, especially by French and Belgians. They may, however, be quite sure of real justice in a German Court.

The World in arms; Germany powerless.

A statement in tabular form for all the Powers, big and little, showing—war strengths and percentages with regard to population of war strength and peace strength.

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Leadership in modern war.

An extract from Oswald Spengler's book—"The downfall of Twilight-land".

Bolshevism.

A review of a book by v. Bothmer "With Count Mirbach in Moscow."

The disbandment of the Austrian army.

Switzerland.

Revue Militaire Suisse.—Aug. 1922.

The future of our army. Col. Lecomte.

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NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—Oct. 1922.

Operations of the Belgian Army. (Contd.)

German Combined Training (V.)

France.

Revue militaire Francaise.—Oct. 1922.

Lt.-Col. Oehmichen. The French High Command in 1916. (Concl.)

Maj. Doumenc. Motor transport in moving warfare. (I.)

Lt.-Col. Gemeau. British Tanks at Cambrai (Nov. 20-23, 1917).

Revue d'Artillerie.—Sept. 1922.

The accompaniment of infantry by trench-mortars (to be contd.) Maj. Schneider.

(An interesting article under the following headings. Preface.

A.—How trench-mortars came to be used for this purpose.

B.—Examples of accompaniment by T.M's.

Reports of officers I. Artois 1915.
II. Somme 1916.
III.—VII. ,, (Officer's letters).

C.—Results attained.

D.—New material (1) Mailly experiments 1916.
(2) Mailly experiments 1917.

E.—Notes on employment of new weapons. The 150 Mod. 17.)

Conic and graphic figuration of the trajectory. Maj. de Saint-Maurice.

Teaming and remounting of the divisional artillery. Capt. de Kersabiec.

Our heavy field artillery during the war. (Concl.) Gén. Fain.

On mountain artillery. (Concl.) Capt. Mortureux.

Anti-aircraft artillery of the U.S.A. Capt. Bénard.

Revue Militaire Générale.—Aug. 1922.

A. Köster.—Could we have continued the fighting?

This commences a series of articles by the present minister of the interior of the Reich.

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The editor's note at the commencement dwells on the historical interest of the article, which emphasizes the absolute and complete defeat of the German Army, material defeat, moral defeat, and national defeat.

Lucius. The recasting of regulations and our war doctrine.

Capt. de Gaulle. "The twilight of a God."

This is a very interesting article on the two von Moltkes.

The first von Moltke was publicly congratulated by William I. on his return to Berlin, an emperor and a conqueror, at a ceremony where the latter was receiving the felicitations of the German people "on having lead the army to victory thanks to his work in time of peace, and methods in time of war."

The writer goes on to say that from thenceforth military Germany worshipped at the shrine of Moltke.

Moltke's peace work had produced a wonderful staff, and unity of doctrine in the Prussian Army.

Mobilization schemes, concentrations, transport, all thought out beforehand under his personal supervision.

In the field, he had little to do with the execution of his schemes.

His Army Commanders had a very free hand, The Crown Prince, Frederic Charles, and Steinmetz, never failed him.

At Königgrätz July 1866—Moltke's conception of the situation on July 1 was wrong and the instructions he gave for the 2nd were not carried out. On the morning of July 2, Frederic Charles's cavalry having found at least 4 Army Corps on the E. bank of the Bistritz, the I. Army Comdr. at once took upon himself to wash out Moltke's orders and go straight for them and fight them and to ask the Crown Prince (II. Army) to co-operate.

It didn't make any difference whether the Staff Colonel who took the message ever got there as the Crown Prince (who'd been told to stay where he was) had already given his army orders to go for the enemy.

Result—Königgrätz.

On August 15, 1870, the French Army of Metz (after various vicissitudes due to the havering of Bazaine) was concentrating on the left bank of the Moselle, N. and N.E. of Gravelotte.

Evening 15th. I. German Army (Steinmetz) is S.E. of Metz after engagement at Borny.

II. German Army (Frederich-Charles) very much scattered is astride the Moselle on a 40 kilo. front and 40 kilo. depth facing W.

Moltke gave orders for the next day to IInd Army—to this effect ". . . . The advantage gained yesterday by Ist Army cannot be exploited by it. It is only by a vigorous offensive by II. Army against the

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roads from Metz to Verdun that we can complete the victory . . . . . ''

Once more Frederic Charles (who had given his own orders at 19 hrs., and received this at 23 hrs. and had plenty of time to cancel his own) took no notice whatever of Moltke's.

Result III. & X. Corps bumped up against the whole French Army about Gravelotte. Only Bazaine's incompetence saved them from disaster.

However the German's having won the battle on 18th all this was proclaimed as according to the system.

Now the writer applies all this to what Maj. A. H. Burne calls "Von Klück's wobble on Paris" (R.A. Journal Vol. XLVII. No. 9. Dec. 1920).

Once more a Moltke.

Once more an Army Commander (Ist Army—von Kluck) taking his own view in direct opposition to G.H.Q. instructions. This time defeat.

Switzerland.

Revue militaire Suisse.—Sept. 1922.

The infantry gun. (Contd.) Jean Fleurier.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Neumann (Major Georg Paul). The German Air Force in the Great War. (Trans.) London (Hodder & Stoughton).

Berdinner (H. F.) With the Heavies in Flanders 1914-1919. A Record of the Active Service of the 24th Heavy Battery, R.G.A. London (Botolph Printing Works) 1922.

Villari (Luigi). The Macedonian Campaign. London (Fisher Unwin) 1922.

Die Wurttembergischen Regimenter im Weltkrieg, 1914-1918. Volumes 1 to 21. Stuttgart (Chr. Belsersche Verlagsbuchhandlung) 1920-22. (Presented by Major V. R. Burkhardt, D.S.O., R.A.)

A quantity of Books which belonged to the late Lieut.-Col. E. F. Calthrop, R.F.A. (Presented by Lieut.-Col. H. G. de Watteville, C.B.E., R.A.)

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PART II.

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Belgium.

Bulletin belge des Sciences Militaires.—Nov. 1922.

Operations of the Belgian Army. (Contd.)

The offensive battle of 21 March—4 April 1918. Part. I. Cap. Comt. Jacquet.

Lieut.-Col. Hentsch and the battle of the Marne. Lt. Fraeys.

Aviation—Gliding in Germany.

German combined training (VI.)

France.

Revue Militaire Générale.—Sept. 1922.

Maj. Grasset. An encounter battle.—Neufchâteau 22 Aug. 1914. (I.)

A. Koster. Could we have continued fighting? (II.)

Gén. Rouquerol. Reflections of an artilleryman.

Pierre Bruneau. The rôle of the High Command from the economic point of view 1914—1921. (IV.)

Capt. Kuntz. Allied strategy and operations in the North. (I.)

Revue Militaire Francaise.—Nov. 1922.

Gén. G. Ferrié. Transmission of orders and intelligence.

Maj. Pugens. The gap between Kluck and Bulow's armies 6—14 Sept. 1914.

Lt.-Col. Mayer. Study of the Art of War.

Maj. Doumenc. Motor transport in moving warfare. (Concl.)

The Counter-Attack of the Moroccan Divn. on April 26th, 1918, at Hangard Wood (nr. Villers Bretonneux.)

In "the military month" the manœuvres at Coetquidan are reviewed.

The theory is that each division carries out a months training divided into three periods (a) Infantry by itself—10 days. (b) Whole division concentrated from 11th to 20th day. (c) The Artillery remains for practice. (For further remarks see French News in *Revue Militaire Suisse* reviewed below.)

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Revue d'Artillerie.—Oct. 1922.

Artillery Fire at targets in the Air and on the Ground. (I.)—Lt.-Col. Eugéne Pagezy.

Notes on the protection of Tanks. Maj. Bloch.

Theory of a 'gliding' projectile. Maj. Alayrac.

Two simple methods of bilateral observation.

The accompaniment of infantry by trench-mortars. (Contd.). Maj. Schneider.

(This months instalment consists of operations of the 2nd, 3rd, and 5th groups of 175th Regt., A.L.P. in October 1918.)

Switzerland.

Revue Militaire Suisse.—Oct. 1922.

The Infantry Gun. (Concl.) Jean Fleurier.

French News :—

The criticism of the French Autumn manœuvres is interesting.

Numbers employed 15,000—mainly cadres—none of the reserve called up.

Remarks on the various arms.

Infantry.

Good class of man, good physique, stood the abominable weather (constant rain and boisterous wind) very well. Well armed but not quite well trained. This is partly due to the fact that with much more complicated weapons the term of service has been so drastically reduced. Formerly when men served 5, 3, or 2 years the infantryman had only to learn the rifle. Now-a-days the rifle is only an accessory to infantry armament and the man's training has to be got through in 18 months, broken into by periods of leave.

Add to this the constant changes in the officer and N.C.O. personnel of the cadres, and you see the difficulty of training the infantry for war.

Cavalry.

Fought on foot. The correspondent says he was told of one regiment of light cavalry who fought an action 15 kilos. ahead of its horses—he compares this to the action of the Infantry of the second empire who put down their knapsacks to fight, drove the enemy from his position and then evacuated the ground gained and went back to pick up their kit!

(It is to be noted that this correspondent is amongst those who think the cavalryman is as dead as the archer and pikeman of old.)

Artillery.

Like the Infantry very well armed, but the personnel did not appear trained in the use of its weapons. As far as firing at the

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right time, that seemed to fit in with the movements of the Infantry and it must be admitted that liaison exists between the two arms.

Where the artillery failed was in the shooting.

After the manœuvres the artillery reoccupied their positions of the preceding days and carried out practice on targets—Results pretty indifferent according to reports. This cannot be wondered at, taking into consideration the class of subaltern officer, and the new Firing Manual. This is a book for "professors," and there are not too many such in the batteries as at the present time there are not more than 3 captains from the école polytechnique commanding batteries.

This hand-book, immediate result of the war is suitable for artillerymen such as existed in the mobilised army (which included temporary officers, who were professors, engineers, etc.) but now the brains of the artillery are limited to the permanent cadres, and it is still most difficult to get recruits for this.[1]

Aviation.

Bad weather prevented any lessons being learnt from the air force.

Tanks.

As for tanks, their method of employment is still in the experimental stage.

General Estienne has introduced certain caterpillar vehicles which are likely to affect modern war.

[1] See "R.A. Journal," Vol. XLVIII., p. 354.

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Corbett (Sir Julian S.) History of the Great War—Naval Operations. Volume I., with case of Maps. London (Longmans Green) 1920.

The Stock Exchange Memorial of those who fell in the Great War, 1914-1919. London (Philip Lee Warner) 1920.

Official History of the Great War. Military Operations, France and Belgium, 1914, with case of Maps. Compiled by Brig.-Genl. J. E. Edmonds, C.B., C.M.G.

Diary of Eleventh Siege Battery, R.G.A. 1914-1918. (Now Eleventh Howitzer Battery, R.G.A.) Printed by E. C. Osborne, Ltd., New Street, Birmingham.

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Belgium.

Bulletin belge des Sciences Militaires.—Dec. 1922.

Operations of the Belgian Army. (Contd.)

The offensive battle of 21 March—4 April 1918. Part II. Cap. Comt. Jacquet.

Light tanks (I.) Col. Poulin.

Artillery Support. Cap. Comt. Brasseur.

(This article applies formulae and graphic methods to this subject.)

German combined training. (VII.)

France.

Revue Militaire Générale. Oct. 1922.

Gén. Magnin. Tactics in Colonial Wars.

Maj. Grasset. An encounter battle.—Neufchâteau 22 Aug. 1914. (II.)

Lucius. The recasting of regulations and our war doctrine. (Contd.)—Post-war problems.

Capt. Liddel Hart. Criticisms of Provisional Infantry Training Manual. 1920.

Capt. Kuntz. Allied strategy and operations in the North (II.)

Revue Militaire Française.—Dec. 1922.

Gén. Camon. The overthrow of the German plan of campaign in Sept. 1914. (I.)

Maj. Pugens. The gap between Kluck and Bulow's armies. (Concl.)

Maj. Doumenc. The 1922 motor show.

Revue d'Artillerie.—Nov. 1922.

The ballistics of bombing from aeroplanes. Col. F. Marie.

Individual protection from gas during the war (I.) Maj. Vautrin

Correction of Series. M. Garnier.

How improvements in the motor industry affect the army. Maj P. Durand.

The accompaniment of infantry by trench-mortars. (Concl.) Maj. Schneider.

Formation of cadres in the Field Artillery. Capt. Mercillon.

Germany.

Artilleristische Monatshefte. No. 189.—September, 1922.

Notes on Anti-Aircraft Defence (conclusion of an article by Hauptmann Dr. Gretsch).

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In the case of the A-A. gun the rival claims of mobility and fire-effect are particularly conflicting. The question of ammunition supply has to be carefully studied.

With regard to organization, the writer points out that the divisional A-A. will have to deal with low-flying armoured planes, the Corps A-A. will have less to do with these, while the A-A. of an Army will chiefly have to put up zones of fire and to protect certain establishments. Accordingly, he suggests the following organization:

Divisional A-A. Artillery.

Small calibre guns. 1 horsed and 1 motor battery of 6 guns each.
Medium calibre guns. 1 horsed and 1 motor battery, each of 4 guns.
Heavy guns (8·8 cm.) 1 battery (motor).

A-A. Artillery of an Army Corps.

Small calibre guns. 1 motor battery (6 guns).
Medium calibre guns. 2 motor batteries (4 guns).
Heavy guns. 2 motor batteries.

A-A. Artillery of an Army (normal).

Small calibre guns. 1 group of 4 motor batteries (6 guns each).
Medium calibre guns. 1 group of 4 motor batteries (4 guns each).
Heavy guns. 1 group of 4 motor batteries (4 guns each).
And 1 group of 10·5 cm. A-A. guns, 2 batteries of 4 guns each at Army H.Q.

The following should be at the disposal of G.H.Q. to be used to reinforce parts of the line and to undertake special work :—

1 group of 4 horse-drawn, small calibre, A-A batteries.
1 group of 4 horse-drawn, medium calibre, A-A batteries.
1 group of 4 motor, small calibre, batteries.
1 group of 4 motor, medium calibre, batteries.
1 group of 4 motor batteries (possibly 2 of 8·8 cm. and 2 of 10·5 cm. calibre).

The anti-aircraft commander of a sector (divisional, corps, army, etc.,) is responsible for all A-A defences (guns, M.G.'s, balloon barriers, searchlights, etc.,) the aircraft reporting service, and supervision of camouflage and concealment of lights within his sector, and for close liaison with the air forces of his formation.

On the march, A-A. guns advance by bounds on the flanks. In position warfare, they will usually be posted in two or more zones parallel to the front line, the front one some 2—3 Km. behind it and about 2—2 Km. deep, the second 2—3½ Km. further to the rear and 3—4 Km. deep.

"The Splinter effect of H.E. shells" (conclusion of an article by General Rohne. Mathematical calculations of the area swept by the splinters from H.E. bursts.

The General concludes that at 2,000 metres a round of shrapnel from a field gun will effectively sweep an area of 996 qm., at 4,000 m. an area of 664 qm., while H.E. will only effectively sweep 330 qm. at

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both ranges. The light field howitzer gives, at 2,000 metres, 80% better results for shrapnel than for H.E., at 4,000 metres 30% less effective for shrapnel than for H.E. The most favourable circumstances being taken for H.E. in all cases.

No. 190. October, 1922.

The new Artillery Regulations.

Discussing certain points, the writer remarks that, even in moving warfare, as soon as a waggon-line is formed, the normal battery establishment is inadequate to the calls made on it. In the war, every battery was given 10 supernumary men.

The practice of unlimbering the waggon-body and leaving it beside the gun in action was early abandoned, the body increasing the difficulties of concealment from the air and the cover of shelter-trenches being preferred to it. Drill should not be complicated by the retention of such battery formations as are of no practical use on service.

Herr Pfeifer has a long technical article on the 100% zone of several guns under various conditions.

"France and long-range Artillery" sketches the rivalry between France and Germany in this branch during the war and points out the tremendous advantage given to France in this respect by the Treaty of Versailles. Even after the evacuation of the Rhineland, the French would cover the whole of it and also the Westphalian industrial area with guns of 150 Km. range such as have now been proved possible. A description is given of new gunnery ranges on the Gascon coast and on the English channel (St. Michael's Bay) 200 and 105 Km. long respectively, with their new railway facilities, provided for in a new bill for presentation to the French Chamber.

Militär Wochenblatt, No. 19.—November 21st, 1922.

General Ludendorff, defending himself against certain charges, states that he was always in favour of a peace treaty which was moderate from the German point of view and which would be accepted by the Entente, but considered it unattainable. Thus, when the 'peace-feelers' of 1917 were discussed, he was against demanding a retention of the Belgian coast line, but in favour of a German annexation up to the line of the Maas near Liege. The various situations, which arose in 1917 and 1918 and the attitude of the German Supreme Command in each, are discussed.

Militär Wochenblatt, No. 20.—December 1st, 1922.

General Ludendorff continues the above article.

v.Taysen discusses new tendencies in the French army with regard to the arming and tactics of infantry.

An article discusses the conscription of labour now in force in Bulgaria and suggests that some such means must be used to get Germany out of her present miserable state, which is only made worse by the 8-hours day law.

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General von Altrock reviews General Baron von Freytag-Loringhoven's book "The Psychology of Armies", a treatise on the psychology of armies throughout history.

A proclamation circulated to the German press by the "Working Committee of German Leagues" calls for national unity to oppose the dictated Treaty of Versailles and the danger of foreign violence threatening Germany.

Switzerland.

Revue Militaire Suisse.—Dec. 1922.

The rôle of Verdun in the battle of the Marne. Capt. Kuntz.

Allgemeine Schweizerische Militärzeitung.—No. 16. August 5th, 1922.

Conclusion of an article by Colonel Sonderegger, chief of the General Staff section of the Swiss Federal Military Department. The article, of which this is the third and last instalment, dealt with various reforms and proposals as to reforms in the Swiss army.

Colonel Sonderegger says that the artillery of the nine elite divisions will consist of 72 batteries of 7·5 cm. guns and 12 batteries of 12 cm. howitzers, the army artillery of 8 batteries of 15 cm. howitzers and 16 batteries of 12 cm. guns. This organization leaves 10 batteries of 12 cm. guns of the mobile fortress artillery for attachment to Corps or divisions as required. This gives an average of 5·83 guns (nearly 1½ batteries) per battalion. Apart from this, the four mountain infantry brigades are each to be provided with three batteries of mobile fortress artillery (partly 7·5 cm. guns and partly 12 cm. howitzers).

Major Curti has an article on shooting a battery by the map. There is little new in it, but he remarks that the 1/25,000 map of Switzerland, in use in the artillery, is very accurate. It is divided into squares of 1 km. side, each square is described by the co-ordinates of its south-west corner. Each square is divided quarterly into a, b, c, and d sub-squares.

Geographic North-South is taken as zero line for giving map bearings (apparently map and true north are taken as identical). The circle is divided into 64 parts, thus East is 16.00 South 32.00 or 0.00, West 16.00 and North 32.00 (or 0.00).

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PRINCIPAL ADDITIONS TO THE LIBRARY.

Hare, (Capt. C. E.) "228". The History of a Siege Battery during the War. Portsmouth (Barrell) 1922.
(Presented by the Author.)

The Rifle Brigade Chronicle for 1921. (Presented by the Editor).

Callwell, (Major-Genl. Sir C. E.) The Life of Sir Stanley Maude. London (Constable) 1920.

Browne, (Capt. D. G.) The Tank in Action. Edinburgh (Blackwood) 1920.

Williams-Ellis, (Major C. and A.) The Tank Corps. London ("Country Life") 1920.

Ellis, (Capt. A. D.) The Story of the Fifth Australian Division. London (Hodder & Stoughton).

Dyer, (Brig.-Genl. R. E. H.) The Riders of the Sarhad. London (Witherby) 1921.

Buchanan, (Capt. Angus) Three Years of War in East Africa. London (Murray) 1919.

Formby, (John). The American Civil War. London (Murray) 1910.

Hall, (Cyril). Modern Weapons of War by Land, Sea and Air. London (Blackie) 1915.

Buchan, (John). A History of the Great War. 4 Vols. London (Nelson).

Atkinson, (C. T.) Marlborough and the Rise of the British Army. London (Putnam) 1921.

Dewar, (G. A. B.) and Lt.-Col. J. H. Boraston. Sir Douglas Haig's Command (Dec. 1915—Novr. 1918). 2 Vols. London (Constable) 1922.

Frothingham, (Capt. T. G.) A Guide to the Military History of the Great War. London (Fisher Unwin) 1921.

Bethmann Hollweg, (Th. von) Reflections on the World War. Part I. (Trans.) London (Thornton Butterworth) 1920.

Farrow, (Edward S.) A Dictionary of Military Terms. London (Library Press).

Waite, (Major Fred). The New Zealanders at Gallipoli. Auckland, N.Z. (Whitcombe & Tombs) 1921.

Davies, (Commdr. R. B.) Use of Aircraft in Naval Warfare. (Aldershot Military Society Lecture No. 119.) (Pamphlet).

Bridge, (F.M.) A Short History of the Great World War. London (Dean) 1920.

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PART II.

NOTES ON FOREIGN JOURNALS.

Belgium.

Bulletin belge des Sciences Militaires.—Jan. 1923.

Operations of the Belgian Army. (Contd.)

Light tanks (II.) Col. Poulin.

Strong points. Cap. Comt. Pacquot.

France.

Revue Militaire Générale.—Nov. 1922.

Gén. Deligny. The 1st Army Corps in the battle of the Marne 6—13 Sept. 1914.

Maj. Grasset. An encounter battle.—Neufchateau 22 Aug. 1914. (III.)

Lucius. The recasting of regulations and our war doctrine. (Contd.)

Col. Defrasse. Transatlantic aerial communications.

Capt. Kuntz. Allied strategy and operations in the North. (III.)

Revue Militaire Française.—Jan. 1923.

Gén. Camon. The overthrow of the German plan of campaign in Sept. 1914. (Contd.)

Lt.-Col. Mussel. Reflexions on the heavy artillery.

Maj. de Tarlé. The reign of the industrial magnates in Germany.

Revue d'Artillerie.—Dec. 1922.

The evolution of the employment of Aviation by the artillery. Col. F. Marie.

On the various natures of Fire. Col. Cambuzat.

Artillery fire at aircraft (II). Lt.-Col. E. Pagezy.

About Saint Barbara. de Lapparent.

The Ordnance Service in the United States. V. Jean.

Germany.

Militär Wochenblatt. No. 21.

"Germany and French intentions on the Rhine." By Lt. Gen. v. Cramon.

The helplessness of England and the lack of interest shown by America make it necessary for Germany to rely on herself alone vis-à-vis French aggression.

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Various people contribute to the contest between Professor Hans Delbrück and General Ludendorff with regard to the latter's conduct in 1917 and 1918.

Second instalment of von Taysen's article on "New tendencies in armament and tactics of the French infantry".

"Observed and unobserved artillery fire" by W.R.

No. 22.

General Ludendorff has a further article defending the conduct of the German supreme command in 1918.

"France's general attack on Germany and the control commissions" by Lieut. General v. Cramon. Another attack by the ex-chief of the liaison office on the I.A.M.C.C. and its chief, General Nollet, couched, as usual, in a heavily sarcastic style.

"The War in the North Sea", review by Admiral Dick of the third volume of the German official history of the war on sea.

"Present French views on the exploitation of Tanks", an exposé of the views of General de Lacroix as set forth in the "Temps".

Switzerland.

Revue Militaire Suisse.—Dec. 1922.

A new book on the Marne—Col. Poudret (reviewing a new book by M. Gabriel Hanotaux.)

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PART II.

NOTES ON FOREIGN JOURNALS.

America.

The Field Artillery Journal publishes a translation of Captain Mortureux's article in the *Revue d'Artillerie* on Mountain Artillery.

May—June, 1922. Chapter I. Limitations imposed by the mountains—consequences and remedies.

Chapter II. Part played by mountain artillery and its use.

July—Aug., 1922. Chapter III. Principal fire problems in mountainous country.

September—October, 1922. Chapter IV. Organisation of the Artillery System and of the Mountain Guns.

Nov.—Dec., 1922. Chapter V. Description of mountain guns of the most recent type.

1st. Schneider guns: 75 m.m. gun and 105 m.m. how., 1919 model.

2nd. Skoda guns: 75 m.m. gun, 15 model, and 10 c.m. how., 16 model.

3rd. English 3·7″ how., 1918.

4th. American 75 m.m. guns, 1920 and 1922.

(Copiously illustrated).

Belgium.

Bulletin belge des Sciences Militaires.—Feb. 1923.

Operations of the Belgian Army. (Contd.).

The support of the advance guard by artillery of the main body (of the Infantry Division). Gén. Hellebaut.

Light Tanks—(III). Col. Poulin.

Notes on foreign armies.—Germany.

The situation as regards the Air service on Dec. 1st 1922.—A. Military Aviation is practically non existant. B. Civil Aviation.

I. Policy followed by the government, and by manufacturers and those interested in aerial routes.

II. Propaganda. The universities and colleges are greatly interested in aviation. Aviation is kept in the eye of the public by lectures, films, exhibitions. Clubs of ex-officers exist and even clubs to run propaganda in foreign countries. Most of the clubs are associated as the "Deutscher Luftfahrt Verband." These propaganda societies are seemingly supported by the State, and certainly by the industry.

III. Aeronautic study—directed by the "Wissenschaftliche Gesellschaft für Luftfahrt"—600 members with a private laboratory and journal.

IV. Construction of Aircraft . . . . Controlled manufacture is of no great importance, but could quickly be expanded . . . .

To escape for the time being the rules imposed by the Allies the aeronautic industry has been partly moved to Holland, Switzerland, Italy and America. A locomotive factory in Jugoslavia has been turned into an aeroplane factory.

V. Commercial aviation.

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France.

Revue d'Artillerie.—Jan. 1923.

Long range air-fights using guns. Lt.-Col. Mussel.

Some remarks on time series. Maj. Menjaud.

Survey and Sound Ranging sections in moving warfare. Maj. Pellion.

On the various natures of fire. (Contd.). Col. Cambuzat.

Revue Militaire Générale.—Dec. 1922.

Gén. Rostovtzeff. What is happening to the Red Army.

Maj. Grasset. A battle of encounter. Neufchateau (22 Aug. 1914). (Concl.).

Lucius. Recasting of regulations and our war doctrine.

Capt. Kuntz. Strategy and operations in the North. (Contd.).

Maj. R. Thys. Nieuport. 1914—1918.

(Maj. Thys of the Belgian Engineers has just produced a book under this title on the inundations of the Yser. The book is obtainable from Messrs. Constable & Co., 10—12 Orange St., London. Price £1/1/0).

A copy has been added to the R.A. Institution Library.

Jan. 1923.

Gen. Palat. The loss of fort Douamont, Feb. 25, 1916.

Lucius. Recasting of regulations and our war doctrine. (Concl.)

Capt. Kuntz. Strategy and operations in the North. (Contd.).

Revue Militaire Française.—Feb. 1923.

Gen. Regnault. The 23rd Division in the Frontier Battle (Aug. 1914).

Maj. Mabille. German post war doctrine.

Lt.-Col. Mussel. Reflections on the heavy Artillery (Artillerie lourde longue) II. (Concluded).

Maj. Laurent. The situation in Germany regarding raw materials.

Switzerland.

Revue Militaire Suisse.—Jan. 1923.

Col. H. Poudret continues his review of Gabriel Hanotaux's new book *La bataille de la Marne.*

In the *French Notes* two articles on the same subject by Professor G. Ferrero (which were published in *l'Illustration*), are reviewed.

Germany.

Artilleristische Monatshefte.—No. 191/192. Nov.-Dec. 1922.

"The Krupp long-range guns." A summary of the published particulars of these guns, their ammunition, ballistics, employment and performances.

"The splinter-effect of high-explosive shells." By Hauptmann Justrow.

The price of this publication, now bi-mensual, will be 2/- for the first half of 1923 for England.

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Militär Wochenblatt.—No. 23. 1st January, 1923.

"Military Review of the year 1922."

The German army has gained in strength, but will naturally require a long time to thoroughly establish its new foundations. The Parliamentary Commission appointed to investigate alleged abuses in the army has produced little of interest to date.

France is striving for the hegemony of Europe. She has no military rival, but, in the economic field, she has to reckon with England and, perhaps, America.

Great Britain's military embarrassment, when war with Turkey threatened, showed how over-hasty was her rapid demobilization. The Dominions showed even less inclination to join in Lloyd George's Turkish adventure than did the mother country.

The Russian army undoubtedly made great progress in organization and equipment in 1922. The lowest grade of soldier receives 2 million roubles per month pay. Nothing indicates that Russia at present meditates an offensive to regain the old imperial frontiers.

The Polish army, 250,000 strong, appears to be good and trustworthy. Much attention is paid to the military training of the youth of the country.

Esthonia keeps 17,000 men under arms, Latvia 18,000, Lithuania 50,000 and Finland 30,000.

General von Cramon has a further article on the Inter-Allied Commission of Control, full, as usual, of venomous personalities and exaggerations.

"The Cavalry Division in the War of the Future." By Colonel Freiherr v. Weitershausen.

After a brief historical survey of the employment of cavalry, the writer concludes that charges by cavalry masses belong to the past and that strategical reconnaissance now falls to aircraft. In future, therefore, the cavalry divisions will only be used as mounted infantry —a mobile reserve in the hand of the Higher Command to be employed as a reinforcement or for long-distance flank-raids.

General Freiherr Kraff v. Dellmensingen comments very favourably on the official history of the part played by the Bavarian army in the war 1914-18.

No. 24. January 15th.

The opening article calls for patriotic unity in the present situation. Disarmed, Germany can only put up a passive resistance, but right and the interests of world economics are on her side.

General von Kuhl discusses the first three volumes of the "Reminiscences of Field Marshal Conrad von Hoetzendorff," late Chief of Staff of the Austro-Hungarian Army.

General Rohne criticizes the article on observed and unobserved fire which appeared in No. 21 of the *Militär Wochenblatt.* Fire should be observed as far as possible. Shooting by the map necessitates large-scale maps and meteorological apparatus and calculations, which are at least as great difficulties in mobile warfare as is the establishment of suitable O.P's

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The commander of a force should only indicate to his artillery commander the area to be bombarded, not fix the expenditure of ammunition. A rolling barrage would be very difficult in mobile warfare. With regard to a gas-barrage, the General estimates (from French data) that an effective gas-barrage on an area 2,000 m. wide and 500 metres deep would require 600 to 700 field guns (75 m.m.) or 60—70 heavy (155 m.m.) howitzers to fire 300 rounds each. Shrapnel should certainly be retained; only in position warfare is it inferior to H.E. shell.

"German History." General von Altrock, praising the work under this name by Karl Brandi, says that the geographical features of Germany and the peculiarities of the national nature have caused a continual rise and fall of the national fortunes.

General Balck and Oberleutenant H. comment on Hauptmann Pfeifer's book on the training of infantry for the attack and defence.

No. 25. February 1st, 1923.

"Pan-Asiatic Objectives." By Major-General (retired) Professor Dr. K. Haushofer.

Dr. Sun-Yat-Sen's designs for a Pan-Asiatic movement, led by Japan, are discussed and the tendency to an understanding between Japan and Russia ("The Russians are Asiatics") is referred to.

General Ludendorff. After the war of 1870-71, Germany, under Bismarck, failed to follow the example set, after the second Silesian war, by Prussia under Frederick the Great. The result was that the German people entered the Great War unprepared ("uneducated")! He calls on all Prussians to take Frederick the Great as a model and again lead Germany in her hour of need.

Lucius Cincinnatus describes and comments bitterly on the events in the Ruhr. There follows a short reference to the seizure of Memel by the Lithuanians.

The German Officers' League has called on the Government to stop the trials of war criminals at Leipzig on the ground that the seizure of the Ruhr is a peace-time crime. The Control Commissions should also be stopped from sniffing around any more.

Wissen und Wehr.—No. 6, 1922.

"Cæsar as Campaigner and Statesman in the Light of the Present Day." The conclusion of the first part of this very interesting study by Oberst Lt. von Giehrl, the well-known writer on military history.

"The Historical Importance of the Cossacks for Russia." A historical survey of the Cossacks by Major v. Cochenhausen, who was liaison officer with the Hetman of the Don Cossacks, 1918-19.

"Politicians and Soldiers in England's Conduct of the War." An Essay founded on "Mr. Lloyd George and the War." By W. Roch, Esq., M.P.

"The peace-time Armies of the Victors and the Vanquished." Continuation of an article by Erwin Hermann. This instalment deals with the armies of Italy, the British Empire, Soviet Russia, U.S.A., Rumania, Yugo-Slavia and Japan.

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The following works are now on sale at the Royal Artillery Institution and will be forwarded to *Members only*, at the prices noted after their titles below. Price to Non-Members, 50% extra.

	s.	d.
"An Officer's Outfit for India." By Lt.-Col. H. A. Bethell, R.F.A. 5th Ed. revised to Jan. 1906. (Plus postage). ...		6
*English-French and French-English Technical, Military and Naval Dictionary. Compiled by Major M. C. Maunsell, late R.A. (Plus postage).	5	6
*English-Italian and Italian-English Naval and Military Terms. Compiled by Major M. C. Maunsell, late R.A. London, 1918. (Plus postage).	4	6
*English-Russian and Russian-English Technical, Military and Naval Dictionary. Compiled by Mr. N. Klishko and Major M. C. Maunsell, late R.A. London, 1918. (Plus postage).	6	0
"Field Gunner's Catechism." By Lieut.-Col. A. T. Anderson, R.F.A. (Plus postage).	1	9
"Hints on Training the Intelligence and Powers of Observation of Officers, N.C.O's and Men." By Colonel L. W. Parsons, C.B., R.A. (Plus postage).		6
"Hints to Officers taking over trafts for India, and conveying them up country to their destination." By Colonel J. C. Dalton, R.A. (4th edition, December 1899), together with "Indian Drafts," by Ration Post. Oct., 1911. (Plus postage).		6
"History & Traditions of the Royal Artillery." By Col. E. A. P. Hobday, C.M.G., R.A. (Plus postage).		6
"History of the Royal Regiment of Artillery, 1815-53." By Lieut.-Colonel H. W. L. Hime, R.A. (Plus postage). ...	6	0
"History of the Royal Artillery, 1853-63." By Col. J. R. J. Jocelyn. 2 Vols:		
Vol. I. Crimean Period. (Plus postage).	14	0
Vol. II. Mutiny Period. (Plus postage).	14	0
"History of the 27th Battery, R.F.A." By Capt. C. M. Vallentin. (Plus postage).	4	0
"History of the 20th Divisional Artillery, 1914-19." By Capt. E. G. Earle, D.S.O., R.F.A.	1	9
"Hunting Notes for Beginners." By Major-Genl. G. H. A. White, C.B., C.M.G., D.S.O. (Plus postage).		6
"Interior Ballistics." By Lieut.-Colonel R. K. Hezlet, D.S.O., R.F.A. (Plus postage).	1	6
"Kane's List of Officers of the Royal Artillery." New edition, Vol. II, June 1862 to June 1914. Price to Members of the R.A.I. 7/6 (Plus postage), to non-members (Plus postage)	12	6
"Logarithmic Slide Rules," (1899) a pamphlet, by Major S. B. von Donop, R.A. (Plus postage).		6
"Modern Artillery in the Field." By Colonel H. A. Bethell, late R.A. Fully illustrated. (Plus postage).	10	0

* These dictionaries are in official use at the War Office and by the Allied Governments

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	s.	d.
"Morals and Maxims for Stable Management and Horse Mastership." By Major R. S. Hardman, R.F.A. (Plus postage).		6
"Narrative of the 5th Divisional Artillery, 1914-18." By Brig.-Genl. A. H. Hussey, C.B., C.M.G. C.R.A. 5th Division, 1915 to 1919. 56 pp. Royal 8vo. Paper Covers, (Plus postage).	2	3
Nomography, or the Graphic Representation of Formulæ. By Major R. K. Hezlet, R.A. (Plus postage)	2	6
"Notes on the early history of the Royal Regiment of Artillery." By the late Col. Cleaveland, R.A. (Plus postage).	2	0
"Notes on Marching a Battery." By Major W. F. Blaker, R.F.A. (Plus postage).		6
"Outline horse," showing points and position of diseases, printed on card-board ... per doz. ...	1	6
	7	6
"Outline horse," showing points and position of diseases, printed on card-board ... 100, Plus postage		
"Practical Field Artillery Training Notes." By Major F. E. Spencer. (Plus postage). ... ... Part I.	1	6
Part II.	2	0
"R.A.I. Library Catalogue." (Plus postage).	1	0
"T.O.B. Ready Reckoner." (For Battery Angle and Range). By Major M. D. Bell, R.A. (Plus postage)).	1	6
"Talks on Leadership. Addressed to Young Artillery Officers." By Basilisk. Hugh Rees, Ltd., 5 Regent Street, S.W. 1. (Plus postage).	1	0
The Gunner's Pocket Notes.—Series I. "The Slide Rule." Series II. "Elementary Electricity", by Capt. John F. Martin, R.A. (Each, Plus postage).		6
"The Royal Regiment of Artillery at Le Cateau, Wednesday, 26th August, 1914." By Major A. F. Becke, (late) R.F.A. (Plus postage).	7	6
"The Services of The Royal Regiment of Artillery in the Peninsular War." By Major John H. Leslie, R.A. (retired list). Chapters I., II & III., August 1808, to end of 1809. (Plus postage).	2	0
The Story of "G" Troop, R.H.A.—Up to the outbreak of War, 1914. By Major H. M. Davson, R.H.A. With five illustrations, and three maps. Price 7/6. (Plus postage). ...	7	6
"The Young officer's Don't, or Hints to Youngsters on Joining." By Maj.-Genl. Sir D. D. T. O'Callaghan, K.C.V.O., 2nd Edition. 1907. (Plus postage).	1	6
"To the Junior Subaltern." By "Esterel." (Plus postage).		2
"With a Siege Battery in France. 303 Siege Battery, R.G.A." (Plus postage).	2	6

NOTE.—A reduction, according to the quantity ordered, is made on *large orders* of small pamphlets.

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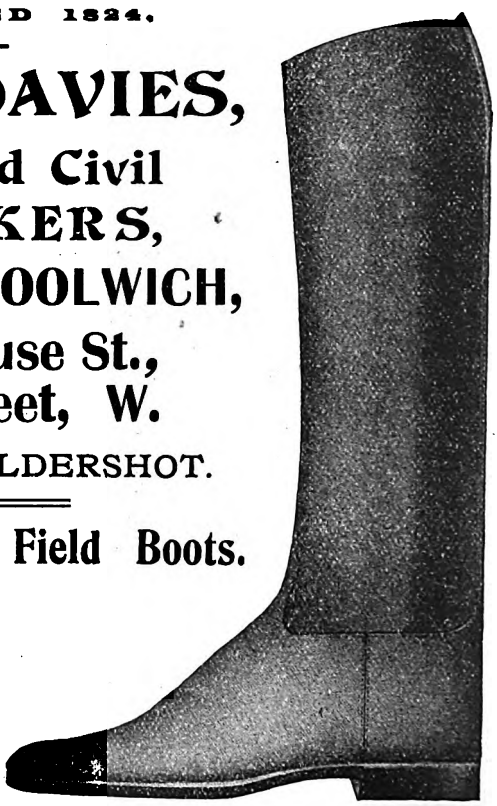

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